STANDARDS OF PRACTICE TO GUIDE ECOSYSTEM RESTORATION

A contribution to the United Nations Decade on Ecosystem Restoration 2021–2030

UNITED NATIONS DECADE ON ECOSYSTEM RESTORATION 2021-2030

Food and Agriculture Organization of the United Nations

UN environment programme

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Standards of practice to guide ecosystem restoration

A contribution to the United Nations Decade on Ecosystem Restoration 2021–2030

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Cover photograph: Arc of mangrove restoration as part of the Building with Nature World Restoration Flagship in Indonesia, starting with community members building permeable structures (credit Nanang Sujana), followed by mud accumulation behind the structures (credit Kuswantoro, Wetlands International) leading to natural recruitment of mangrove seedlings, crabs and other organisms (credit Apri Susanto, Wetlands International).

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BACKGROUND

The Taskforce on Best Practices, established under the leadership of the Food and Agriculture Organization of the United Nations (FAO), is a collaborative effort of ca. 300 members from more than 100 global organizations that supports capacity development and knowledge dissemination to help achieve the vision of the United Nations Decade on Ecosystem Restoration (hereafter, the “UN Decade”). In 2021, the Taskforce on Best Practices, the Society for Ecological Restoration (SER) and the International Union for Conservation of Nature Commission on Ecosystem Management (IUCN CEM) partnered to lead an inclusive effort to draft ten guiding principles[1] that underpin the full set of ecosystem restoration activities, in collaboration with the Center for International Forestry Research and World Agroforestry (CIFOR-ICRAF), the EcoHealth Network, the World Wide Fund for Nature (WWF) and the United Nations Environment Programme (UNEP). After the release of the principles in September 2021, and following the same participatory approach, the partnership continued to coordinate the development of the *Standards of practice to guide ecosystem restoration* (hereafter, *Standards of practice*) to provide guidance on the application of the ten principles to all components of the restoration process, with authors from 25 organizations (see authors).

PROCESS AND METHODS

The development of the *Standards of practice* started with a review of existing guidance documents for all types of activities defined as ecosystem restoration under the UN Decade, including rehabilitation, reclamation, forest and landscape restoration, ecological restoration, sustainable or ecological agriculture and forestry, rewilding, other effective conservation measures (terrestrial or in aquatic ecosystems) and other activities. These documents were obtained through a global request distributed via email to members of the UN Decade Taskforce on Best Practices, SER and IUCN CEM. A total of 201 respondents suggested 127 unique standards of practice documents. Suggested documents covered a wide range of management activities, ecosystem types, aims, geographical locations and audiences. After review, the most universally relevant documents (listed below) were selected for extracting best practices. To the extent possible, redundant practices were eliminated. Practices were then organized into components and subcomponents of the restoration process. The initial set of components, subcomponents and practices were subject to a series of consultative processes, including: i) a global forum in which over 70 scientists and practitioners collaboratively reviewed and revised the practices for each subcomponent within each component (April and May 2022); ii) an invitation to provide feedback and inputs distributed to leads and members of the UN Decade taskforces, the UN Decade Strategy Group, the Science and Policy Committee of SER and leaders of IUCN CEM (August 2022); and iii) consultations at the XV World Forestry Congress (May 2022), the Thirteenth European Conference on Ecological Restoration (September 2022) and the Twenty-Sixth Session of the FAO Committee on Forestry (October 2022). All feedback and inputs were evaluated and considered in the creation of a second draft, which was subjected to a one-month open global consultation advertised to the restoration community and available on the UN Decade website. Over 400 individuals from diverse organizations and geographic regions provided comments during the global consultation. Each comment was evaluated, and the text was adjusted as appropriate to create a beta version of the *Standards of practice*. The beta version was then subject to a targeted consultation with Indigenous Peoples, facilitated by the Indigenous Peoples Unit of FAO. Under this consultation, a drafting committee was established with eight members of the Global-Hub on Indigenous Peoples' Food Systems. Their substantial inputs were then integrated into the final version to enhance the recommendations that need to be considered when restoration efforts involve or affect Indigenous Peoples and their territories.

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Restoration activities provide livelihoods for local residents as part of the Shan-Shui Initiative World Restoration Flagship in China

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INTRODUCTION

The United Nations Decade on Ecosystem Restoration 2021–2030 (hereafter "UN Decade") aims to prevent, halt and reverse ecosystem degradation and recover biodiversity, and ecosystem integrity; enhance human health and well-being, including sustainable delivery of ecosystem goods and services; and mitigate climate change. To create a shared vision of ecosystem restoration, UN Decade partners, through a consultative process, launched ten principles[1] (Figure 1) for achieving the highest level of recovery possible through restoration projects. To facilitate application of these principles and thereby maximize restoration outcomes for nature and people, the *Standards of practice to guide ecosystem restoration* (hereafter, *Standards of practice*) provides key recommendations for all phases of restoration projects. These recommendations are applicable to the broad array of restorative activities included as ecosystem restoration under the UN Decade (Figure 2), across all types of ecosystems (urban, production, cultural, semi-natural and natural) and restoration projects, from voluntary community member-led efforts to highly resourced, nationally funded projects.

The *Standards of practice* were developed by synthesizing a large volume of existing best practice guidance for a broad array of restoration activities, from sustainable agriculture to ecological restoration, as well as the recommendations of the Science Taskforce for the UN Decade.[2] Practices have been organized into five components in the restoration process (Figure 3). The **assessment** component includes the identification and evaluation of the extent and scale of degradation, considering the site and its context within the landscape or seascape. The **planning and design** component focuses on determining appropriate restoration activities given the project's ecological, cultural and socioeconomic contexts, as well as financial constraints. Restoration targets are identified, and specific restoration goals and objectives are developed by stakeholders (e.g. local communities), rights and knowledge holders (e.g. Indigenous Peoples), practitioners and other experts, or through active engagement with them. Planning foreshadows all the work that will be undertaken during the project's **implementation** component, whereas the **ongoing management** component considers short- and long-term project needs following the completion of planned implementation activities. Finally, the **monitoring and evaluation** component focuses on measuring progress towards the recovery of the restoration targets and achievement of the restoration goals and objectives, and evaluating findings to determine possible course corrections and improvements and share lessons learned.

PRINCIPLE 1:

Ecosystem restoration contributes to the UN Sustainable Development Goals and the goals of the Rio Conventions.

PRINCIPLE 2:

Ecosystem restoration promotes inclusive and participatory governance, social fairness and equity from the start and throughout the process and outcomes.

PRINCIPLE 3:

Ecosystem restoration includes a continuum of restorative activities.

PRINCIPLE 4:

Ecosystem restoration aims to achieve the highest level of recovery for biodiversity, ecosystem health and integrity, and human well-being.

PRINCIPLE 5:

Ecosystem restoration addresses the direct and indirect causes of ecosystem degradation.

PRINCIPLE 6:

Ecosystem restoration incorporates all types of knowledge and promotes their exchange and integration throughout the process.

PRINCIPLE 7:

Ecosystem restoration is based on well-defined short-, medium- and long-term ecological, cultural and socioeconomic objectives and goals.

PRINCIPLE 8:

Ecosystem restoration is tailored to the local ecological, cultural and socioeconomic contexts, while considering the larger landscape or seascape.

PRINCIPLE 9:

Ecosystem restoration includes monitoring, evaluation and adaptive management throughout and beyond the lifetime of the project or programme.

PRINCIPLE 10:

Ecosystem restoration is enabled by policies and measures that promote its long-term progress, fostering replication and scaling-up.

Figure 1. The *Standards of practice* provide key recommendations for application of the ten principles of ecosystem restoration

Notes: The *Standards of practice* were developed to assist restoration implementers (including community members, Indigenous Peoples, practitioners, researchers, land users and others) with developing restoration projects that reflect the ten principles of ecosystem restoration for the UN Decade (depicted above). Recommended practices address principles directly related to selection and management of restoration activities at project sites (principles 3, 4, 7 and 9), as well as principles that apply beyond the project site to prevent misuse of resources and unintended consequences (principles 5 and 8). In addition, the *Standards of practice* provide recommendations for addressing enabling conditions (principles 2, 6 and 10), and assessing and applying lessons learned from the outcomes of restoration activities to improve the restoration process and foster replication of effective practices (principles 9 and 10). Finally, the recommended practices assist restoration projects with contributing to the United Nations Sustainable Development Goals and the goals of the Rio Conventions (principle 1), and allied global initiatives. Some of these practices (denoted with colored shading behind the text) are aspirational and may be beyond the scope of most restoration projects. The recommended practices in the *Standards of practice* generally apply to multiple UN Decade principles. For this reason, they have been organized by components of the restoration process (Figure 3) rather than by principle.

Source: **FAO, IUCN CEM & SER**. 2021. *Principles for ecosystem restoration to guide the United Nations Decade 2021–2030*. Rome, FAO. www.fao.org/documents/card/en/c/CB6591EN

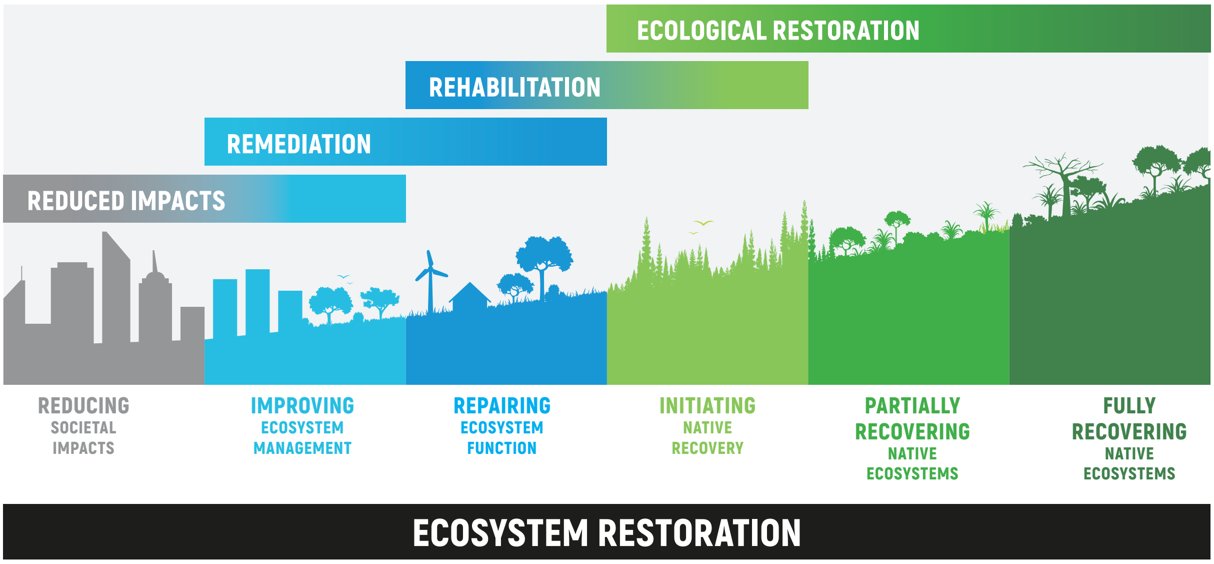
ECOLOGICAL RESTORATION
REHABILITATION
REMEDIATION
REDUCED IMPACTS
REDUCING SOCIETAL IMPACTS
IMPROVING ECOSYSTEM MANAGEMENT
REPAIRING ECOSYSTEM FUNCTION
INITIATING NATIVE RECOVERY
PARTIALLY RECOVERING NATIVE ECOSYSTEMS
FULLY RECOVERING NATIVE ECOSYSTEMS
ECOSYSTEM RESTORATION

Figure 2. **Four major categories of restoration activities along the restorative continuum**

Notes: The restorative continuum includes four main categories of restorative activities: (1) reduction of negative environmental and societal impacts, such as pollution and unsustainable resource use and management; (2) removal of contaminants, pollutants and other threats, often known as remediation; (3) rehabilitation of ecosystem functions and services in highly modified areas such as former mining sites and degraded production systems; and (4) ecological restoration, which aims to remove degradation and assists in recovering an ecosystem to the trajectory it would be on if degradation had not occurred, accounting for environmental change.

Source: Modified from **Gann, G.D., McDonald, T., Walder, B., Aronson, J., Nelson, C.R., Jonson, J., Hallett, J.G. *et al.*** 2019. International principles and standards for the practice of ecological restoration. Second edition. *Restoration Ecology*, 27(S1): S1–S46. https://doi.org/10.1111/rec.13035

Although the five components of the restoration process are presented in a sequential order, the restoration process is not linear, and practices within different components should be conducted simultaneously or in a different order than presented in the *Standards of practice*. For example, while the initial assessment of project site conditions should be completed before the development of the restoration plan, other activities included in the assessment component, such as baseline monitoring, should be done only after completion of the monitoring and evaluation plan (which is part of the restoration plan). This is because for the baseline monitoring to provide the benchmark for later monitoring, it must be conducted in a manner that is consistent with post-restoration monitoring. Additionally, developing the monitoring and evaluation plan in tandem with the restoration plan is necessary to verify that restoration goals and objectives are measurable, and that the overall project budget includes sufficient resources for monitoring, among other reasons. Thus, although monitoring is presented as the last component of the *Standards of practice*, some practices associated with monitoring, including developing the monitoring and evaluation plan, must be completed either before or at the same time as practices within the assessment and planning and design components.

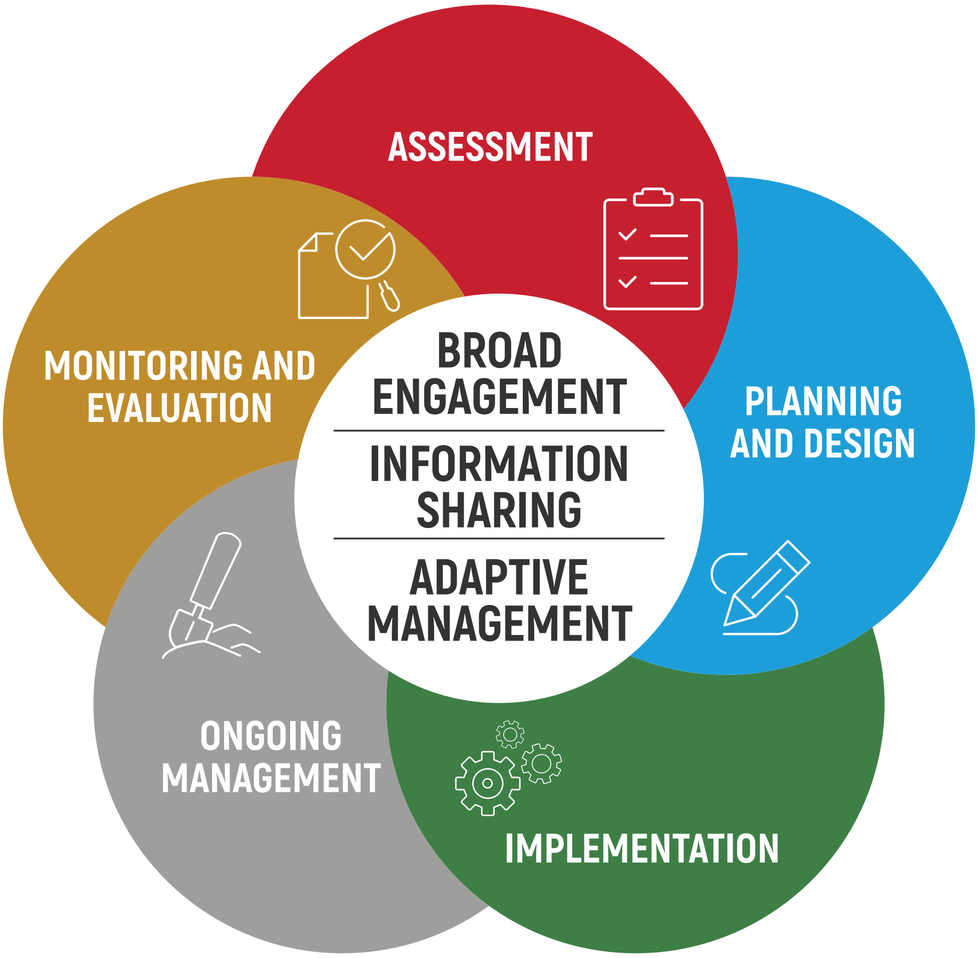
ASSESSMENT
PLANNING AND DESIGN
IMPLEMENTATION
ONGOING MANAGEMENT
MONITORING AND EVALUATION
BROAD ENGAGEMENT
INFORMATION SHARING
ADAPTIVE MANAGEMENT

Figure 3. The five components of the restoration process along with cross-cutting subcomponents that apply throughout

Notes: Although presented in a sequential order, the restoration process in not linear, and subcomponents within different components may be conducted simultaneously or in a different order than presented in the *Standards of practice*. Furthermore, practices associated with broad engagement, information sharing (information management and record-keeping; and communication and reporting) and adaptive management should be implemented throughout the restoration process and, therefore, have been included within "cross-cutting" subcomponents that are repeated in more than one component.

Within each of the five components of the restoration process, related practices have been organized into subcomponents. However, some aspects of restoration, such as broad engagement, information sharing and adaptive management, cross-cut the five components (centre of Figure 3). For this reason, each of these three aspects of restoration is repeated across multiple components in the *Standards of practice*. In all cases where cross-cutting subcomponents are included in more than one component of the restoration process, the recommended practices are tailored for each component.

Broad engagement, included as the first cross-cutting subcomponent, should be fostered and maintained during the full cycle of the project. This is because the likelihood of restoration success greatly increases when each component of the process is informed by and includes equitable, inclusive, genuine and continuous engagement of those directly or indirectly involved in, or affected by, restoration activities, including stakeholders and rights and knowledge holders, especially Indigenous Peoples and key groups. In the context of this document, key groups are those that historically have not had equitable influence in decision-making in a specific context (e.g. Afro-descendants, ethnic minorities, LGBTIQ+ people, pastoralists, people with disabilities, religious minorities, rural communities, the elderly, women and youth).[3] In addition, long-term sustainability of restoration projects is only possible via co-design, co-management and co-governance with stakeholders and rights and knowledge holders and, therefore, broad engagement should not be limited to a single component of the restoration process, such as planning. Restoration projects should be designed to respect cultural, spiritual and knowledge traditions of stakeholders and rights and knowledge holders and the rights of all involved. Projects involving Indigenous Peoples and their territories, lands, waters and natural resources, must acknowledge them as rights and knowledge holders and respect their collective rights, including the right to self-determined development, and the adherence in the restoration work to the process of free, prior and informed consent (FPIC), as defined in Articles 10, 11, 19, 28 and 29 of the 2007 United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP).[4] This process must be integrated into the project from its initial conception, to ensure that traditional governance mechanisms are integrated into governance of the project and to pursue the future sustainability of the restoration efforts. The *Standards of practice* highlight the importance of the meaningful involvement of Indigenous Peoples, as well as best practices for engaging them, within breakout boxes and throughout the main text for each component of the restoration process.

Regular and inclusive **information sharing**, including information management and record-keeping as well as reporting and communication of activities, is included as the second type of cross-cutting subcomponent. Practices associated with information sharing are required within all components of the restoration process to promote and sustain transparency, broad engagement and support; facilitate understanding, implementation and evaluation of restoration activities; and to enable knowledge exchange, mutual learning and adaptive management (see below). Accurate and timely reports will also enable clear and reliable communication of project achievements and lessons learned, which in turn will reduce potential risks of misinformation and mistrust regarding the distribution of benefits of the restoration project. Sharing project information also allows for aggregation of data across projects, which is critical for tracking the impact of restoration at local to global scales, a key need for documenting progress towards achieving restoration goals within United Nations Rio Convention initiatives (e.g. United Nations Convention on Biological Diversity's Kunming-Montreal Global Biodiversity Framework).

Adaptive management, a systematic process for continually improving policies and practices by learning from the outcomes of restoration, requires specific practices throughout the restoration process and, therefore, has also been included as a cross-cutting subcomponent. Adaptive management is key to successful ecosystem restoration, given that restoration is a long-term endeavour for which there is general uncertainty about efficacy and effects in the context of social, economic, political and climatic forces. The adaptive-management cycle includes all the components of the restoration cycle. However, not all projects that include all five components follow an adaptative management framework. While it is always possible to learn from doing, adaptive management differs from unplanned "learning by doing" in that it strategically connects assessment, planning and design, implementation, ongoing management, and monitoring and evaluation of restoration activities in a structured way to enhance project success. For instance, adaptive management is only possible if part of the planning process includes agreement to use approaches that allow for reliable assessment of outcomes and have defined pathways for incorporating lessons learned into project design and implementation. At predefined time intervals, the cycle of assessment, planning and design, implementation, ongoing management, and monitoring and evaluation repeats itself, thus allowing projects to adapt over time and change activities when outcomes deviate from original restoration goals and objectives. This iterative process helps to refine restoration goals and objectives by explicitly addressing complexity in environmental, cultural and socioeconomic factors and outcomes. Although following an adaptive-management process may cost more than static or linear approaches to ecosystem restoration, over the project lifetime, it can avoid or reduce potentially costly mistakes and large-scale failures, and promote efficiency and effectiveness.

The *Standards of practice* include 45 subcomponents (hereafter SCs) and over 300 recommended practices (hereafter Ps) that can assist restoration implementers (including community members, Indigenous Peoples, practitioners, researchers, land users and others) with developing restoration projects that reflect the UN Decade principles[1] (Figure 1) and maximize net gain for biodiversity, ecosystem integrity and human well-being. However, adherence to the practices within the *Standards of practice* is voluntary. Furthermore, not all practices will apply to every restoration project, given the high degree of variability among projects with respect to the organizations and actors involved (e.g. Indigenous Peoples, land users, non-governmental organizations, government agencies, local communities and the private sector), resource availability (e.g. low budget to highly financed) and spatial scale (e.g. one or a few small sites to multiple large sites across landscapes or seascapes). These differences may influence the number and types of best practices that are appropriate for each project. Regardless of whether a project incorporates only a few practices from the *Standards of practice* or implements most

Improvement of water availability, water quality and harvest of goldfish (*Carassius auratus*), Amur catfish (*Silurus asotus*) and snakehead (*Channa argus*), as part of the Shan-Shui Initiative World Restoration Flagship in China

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of them, a synthetic understanding of the complete set of recommended practices should facilitate decision-making about which practices to include, as well as the need to navigate trade-offs, with the aim of achieving the highest level of recovery possible for nature and people (principle 4).

By providing a common framework across the restorative continuum (Figure 2), these *Standards of practice* build on and support restoration principles, standards, and other guidance developed for specific biomes and restoration approaches (e.g. ecological restoration, landscape restoration, nature-based solutions; see list in the appendix). As such, the *Standards of practice* can assist in revision of existing guidance to align with the principles and recommendations for ecosystem restoration under the UN Decade. In addition, the *Standards of practice* can facilitate the development of new local, biome-, approach- or sector-based guidance that may be needed in the future and support the development of a robust ecosystem restoration profession, as ecosystem restoration is scaled up across the globe. Finally, the recommended practices assist restoration projects with contributing to the United Nations Sustainable Development Goals and the goals of the Rio Conventions (principle 1). Achieving these goals requires more than just practices at the project scale, but also aspirational practices that are likely beyond the scope of most restoration projects (denoted with colored shading behind the text in the *Standards of practice*) but that are critical for maximizing the outcomes of ecosystem restoration for nature and people.

BOX 1. INDIGENOUS PEOPLES AS GAME-CHANGERS FOR ECOSYSTEM RESTORATION

Indigenous Peoples have an important and unique role to play in ecosystem restoration. Collectively, they have been stewards of over 40 percent of the landmass and have done so in a sustainable fashion for millennia. Their cumulative knowledge and expertise in managing, conserving and restoring ecosystems, as well as their proven knowledge of management of their territories, are essential for effective restoration and conservation of natural environments and socioecological systems both within and adjacent to areas where they reside.

Indigenous Peoples' biocentric and biocultural restoration are recognized as inclusive and rights-based, and grounded in their knowledge of territorial management. From a biocentric perspective, Indigenous Peoples place their cosmogony and belief systems, the environment and biodiversity at the centre of their restoration practices, in both natural and semi-natural ecosystems. They respect nature per se, independently of the uses that humans derive from it. This follows a biocentric logic, which means that rivers, lakes and forests have rights for existence that are not necessarily linked to their utilitarian value. Nature is combined with sacrality and considered as a living entity with societies inseparable from their environments. Indigenous Peoples' biocentric restoration, which was articulated by Indigenous Peoples and the FAO Indigenous Peoples Unit in 2018, is a holistic restorative approach based on the cosmogony of Indigenous Peoples, as well as their food and knowledge systems. This approach recognizes the collective and customary rights of Indigenous Peoples and bases restoration on their collective work, and involves communities and households in conservation and restoration activities. It considers all living beings in the ecosystem, as well as their relations and interactions with both biotic and abiotic elements. This includes, for instance, restoring connectivity among forested areas to maintain fauna and flora and residents of Indigenous Peoples' communities, lands and territories. Indigenous Peoples' biocentric restoration is based on Indigenous Peoples' food and knowledge systems, culture, cosmogony and spiritual belief systems, which are interrelated and interconnected. It fosters communities to use their traditional knowledge to restore the memory of their territories.

In general, any restoration effort that involves or affects Indigenous Peoples and their territories must recognize their self-determined development, as well as customary and collective rights to their territories, natural resources, and land and marine environments. Considering their profound understanding of the environment, ancestral wisdom and unique knowledge and expertise, ecosystem restoration projects should foster the active and meaningful involvement of Indigenous Peoples throughout the restoration process, from assessment to monitoring and evaluation, particularly when Indigenous Peoples are not the project initiators. This involvement must include recognizing their biocentric approach and ensuring their free, prior and informed consent (FPIC) throughout all phases of restoration, and uphold values of respect, trust, equity and empowerment. In this regard, it is important to identify and address potential risks in exchanging natural and cultural Indigenous Peoples' knowledge with other types of knowledge.

When conducting ecosystem restoration, it is important to consider how ecosystem degradation may be caused by the non-recognition, transculturation, violation of rights and forced displacement of Indigenous Peoples. In some countries, Indigenous Peoples are not recognized by current governments, despite endorsement of the 2007 United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP).[4] Also, there is a lack of acknowledgement of the deep spiritual, cultural and socioeconomic connections of Indigenous Peoples with their lands, territories and resources. Unfortunately, Indigenous Peoples across the world often suffer encroachment on their territories, and lack of respect for their customary governance systems. Further, yet common, complications occur when governments and agencies give away Indigenous Peoples' lands and territories in

Maasai women from the Namaiyana Cultural Group performing traditional dances in the Mukogodo Forest in Arjiju, Kenya

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concessions without consent, or when creation of protected areas results in their forced eviction from ancestral lands and territories. Such displacement often leads to violence, conflict and ecosystem degradation. These problems are exacerbated by the disproportionate impacts of climate change and extreme weather events on Indigenous Peoples, and their lands and waters. Consequently, restoration projects should strive to implement strategies that help address these challenges, in order to avoid hampering Indigenous Peoples' meaningful participation, integration of their knowledge, and roles as custodians of knowledge and their ecosystems. Additionally, key policy processes that involve ecosystem restoration activities such as the formulation, updating and implementation of National Biodiversity Strategies and Action Plans (NBSAPs), nationally determined contributions (NDCs) or nationally appropriate mitigation actions must recognize the fundamental role and contributions of Indigenous Peoples in addressing biodiversity and climate crises, as well as their rights.

The considerations related to Indigenous Peoples in the *Standards of practice* constitute valuable recommendations to restoration projects on how to follow an inclusive and rights-based approach when involving Indigenous Peoples in restoration projects. Although the Standards of practice are voluntary, Indigenous Peoples' rights are enshrined in international law (such as the UNDRIP,[4] the Convention on Biological Diversity [CBD] and related protocols) and should be seen as a precondition to any restoration assessment and planning. The inclusion of Indigenous Peoples is important to improve outcomes of restoration projects, and it is especially important where they live within or adjacent to the project area. Following an inclusive, rights-based approach will help promote the meaningful participation of Indigenous Peoples and should contribute to enhancing their well-being, as well as the long-term sustainability of the restoration.

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Community nursery mapping workshop in Yalokombe, the Democratic Republic of the Congo

ASSESSMENT

Restoration projects are most likely to maximize benefits to nature and people when planned in the context of conditions at both the local site and the larger landscape or seascape that contains them. This is because ecosystems are both affected by and have effects on the larger landscape or seascape in which they are embedded and, therefore, cannot be managed in isolation. Well-implemented ecosystem-level restoration projects may fail if threats from the larger landscape or seascape (e.g. contamination, invasive species, and altered longitudinal or lateral hydrologic connectivity) are not recognized and addressed. Furthermore, the composition, structure and functions of an ecosystem may depend on inputs from the larger landscape (e.g. energy, nutrients or propagules). Moreover, ecosystem services, such as the provision of water and protection from natural hazards, are not only provided from single ecosystems, but from landscape- or seascape-level composition, structure and processes. For these reasons, decisions about where to locate project sites should be informed by a landscape- or seascape-level spatial prioritization assessment, ideally based on multiple criteria and with stakeholder and rights and knowledge holder participation. Because the *Standards of practice* are primarily focused at the project level, specific recommendations for this spatial prioritization, which should occur before engaging at the project level, are not included.

Once project sites have been selected based on the spatial prioritization, an assessment of their ecological, cultural and socioeconomic conditions and broader context in the landscape or seascape is needed to identify the initial level of degradation and to inform development of the restoration vision, identify restoration targets and define restoration goals and objectives. Restoration targets are the ecological, cultural or socioeconomic element(s) on which the project will focus and, therefore, will be enhanced through the restoration activities. Goals detail the project's desired long-term outcomes and degree of recovery, whereas objectives are the desired short- to medium-term outcomes, such as reducing a critical threat, that are needed to accomplish the goals. If the project is well designed, achieving a project's objectives should lead to the realization of the project's goals and ultimately its vision.

Most restoration projects are conducted at the local or community level, and local stakeholders as well as rights and knowledge holders may have knowledge of both the factors causing degradation and of the solutions. Therefore, broad engagement by stakeholders and rights and knowledge holders is critical during assessment (SC1). This engagement is important to maintain dialogue, build trust, exchange knowledge and learn; enable adaptation to necessary changes; allow emerging problems to be addressed early; and foster long-term engagement and interest in the project.

A restoration project starts with demarcation and assessment of the project sites (SC2), including a general description of their physical (e.g. topography, hydrology) and biotic components (e.g. species composition, ecosystem structure). The sources of degradation and their effects on biodiversity, ecosystem integrity, and human health and well-being must be identified so that a plan for reducing, mitigating or eliminating those threats can be developed. Information on land use, livelihoods and potential cultural and socioeconomic barriers to restoration should also be obtained.

It is also necessary to assess conditions within the larger landscape or seascape surrounding project sites (SC3), for the reasons mentioned in the initial paragraph of this section. Assessment should include the biophysical and environmental conditions, cultural and historical influences, socioeconomic realities, and policy and legal contexts. Potential barriers to restoration and external threats, as well as fragmentation and connectivity, should be evaluated at this scale. It is also necessary to fully identify stakeholders and rights and knowledge holders, and relevant governance structures, as part of the assessment of the project's broader context.

A detailed assessment of the pre-restoration condition (baseline monitoring, SC4) of the proposed project sites, including key attributes of the restoration targets to be restored, should be conducted in advance of implementation of restoration activities. This baseline monitoring extends the initial assessment of site conditions (SC2) by measuring specific indicators of key ecological, cultural and socioeconomic attributes. Baseline monitoring provides a benchmark for measuring change following implementation, optimally using the same indicators as those that will be measured for project monitoring. For this reason, the monitoring and evaluation plan (SC36) needs to be completed in advance of the baseline monitoring.

The degree and scope of degradation of the project sites can be determined by comparing the sites with a "reference model" that characterizes the ecological condition that the project sites would have been in if degradation had not occurred (SC5). This model can be used to assess degree of recovery at the project sites, and for setting goals for some types of restorative activities (e.g. ecological restoration). Practices associated with identifying reference sites and other information needed to develop the reference model should be conducted prior to implementation of restoration activities.

BOX 2. INDIGENOUS PEOPLES' CONTRIBUTIONS TO ECOSYSTEM RESTORATION ASSESSMENT

Given Indigenous Peoples' depth of experience as ecosystem stewards, project assessments (at site and landscape or seascape level) and the subsequent identification of restoration targets, goals and objectives must incorporate their knowledge and desired outcomes. Assessments should recognize the importance of the diverse types of terrestrial and marine ecosystems that may be included within Indigenous Peoples' lands and territories, as well as the systems of knowledge and governance present in those territories. Furthermore, assessments must recognize Indigenous Peoples' knowledge and management practices in both maintaining ecosystems and combating ecosystem degradation. These considerations should be incorporated into assessment methodologies. In addition, the identification of desired outcomes of restoration must go beyond environmental benefits and include, for example, contributions to food security and nutrition (e.g. preserving, restoring and strengthening Indigenous Peoples' food and knowledge systems); where appropriate, agriculture and food generation that utilize non-degrading practices; and cosmogonic and spiritual beliefs and respect for cultural and sacred sites. Finally, assessment of restoration sites and the larger landscape or seascape should not undermine customary land, territory and resource uses of rights and knowledge holders and must be based on free, prior and informed consent (FPIC).

ASSESSMENT

SC1 BROAD ENGAGEMENT

SC2 ASSESSMENT OF SITE CONDITIONS

SC3 ASSESSMENT OF LANDSCAPE OR SEASCAPE CONTEXT

SC4 BASELINE MONITORING

SC5 REFERENCE MODEL

SC1 Broad engagement

Successful restoration is dependent on engagement and support of people who may be affected by or interested in the project. During the assessment component, it is critical to carefully identify all stakeholders and key groups, as well as rights and knowledge holders, especially Indigenous Peoples, and their social relationships. Involving local stakeholders and rights and knowledge holders can improve assessment of site and landscape or seascape conditions, baseline monitoring, and identification of potential reference sites because these actors have valuable knowledge and historical information about the project sites (e.g. past and current uses; ecological, cultural and socioeconomic conditions; and legal context). In addition, an inclusive approach to assessment is important to identify barriers to participation in the restoration process by Indigenous Peoples and key groups, including land tenure issues (SC8), power or social asymmetries, crossed interests and cultural misconceptions that often drive other actors operating in the territory. For these reasons, stakeholders and rights and knowledge holders should be encouraged to actively engage in assessment activities, which should be based on all types of knowledge (local, traditional, practitioner, scientific and Indigenous Peoples' knowledge). Communicating in local languages is fundamental to foster meaningful and inclusive participation, and to avoid misunderstandings and gaps in restoration approaches that might be counterproductive.

P1. Identify the full range of stakeholders and rights and knowledge holders, and individuals and organizations who may be affected by or interested in the restoration project locally. It is important that Indigenous Peoples and key groups are included.

P2. Analyse the social structure (often referred to as the social network) that exists among project participants and stakeholders and rights and knowledge holders, to identify any missing groups as well as opportunities for strengthening the network, and for identifying possible collaboration or potential conflicts.

P3. Invite and encourage stakeholders and rights and knowledge holders to participate and contribute their knowledge and experience in co-developing or co-creating the assessment of the project.

P4. Obtain FPIC when engaging with Indigenous Peoples.

P5. Ensure enabling conditions for all stakeholders and rights and knowledge holders to participate, especially Indigenous Peoples and members of key groups, and consider their languages, literacy levels, and possible power or social asymmetries.

P6. Understand the existence and interaction of multiple Indigenous Peoples' food and knowledge systems and their roles in maintaining biodiversity, to identify potential restorative activities to be implemented at the project sites.

SC2 Assessment of site conditions

A well-designed and conducted site assessment is important for identifying sources and extent of degradation, developing the restoration vision, identifying the targets, establishing specific restoration goals and objectives, and planning restoration activities. Site assessments will vary from basic and rapid, to complex and detailed. However, to be most useful, assessments of site conditions should include information on: i) past land and water uses, and direct and indirect drivers of degradation (e.g. pollution from production landscapes or seascapes; ii) habitat loss from land-use change and infrastructure development; iii) anthropogenic disturbances such as fires and contamination; iv) the socioeconomic systems associated with the sites (e.g. main economic activities and sources of income for communities, current land tenure and use [SC8]), and other social and cultural considerations; v) abiotic conditions (e.g. topography, substrate properties, hydrology); vi) biotic conditions (e.g. species composition, including presence of keystone species and species of conservation concern, and ecosystem structure) and potential for organisms to recover by themselves after threats are removed; vii) ecosystem functions; viii) natural disturbance processes; ix) species of economic or cultural value; and x) potential future threats (e.g. such as extreme climatic events or infrastructure development).

P1. Identify for the restoration project sites their geographic locations (e.g. country, subnational jurisdiction, local jurisdiction, legal address); ecosystem type(s); past and current ecological site descriptions (e.g. written records, aerial and ground-based photographs); and past and current uses.

P2. Determine physical site characteristics including elevation, topography (e.g. slope, aspect and exposure), geomorphology, soil or sediment type and condition, water quantity and quality, surface hydrology or hydrography, and climate history. Maps or remote-sensing information may provide much of this information but should be supported by onsite examination.

P3. Obtain information and conduct site visits to assess plant and animal community composition, including identifying:

- functional groups of micro- and macroorganisms, including pioneer and late successional species;
- species that greatly influence an ecosystem (keystone or flagship species), are of conservation concern, are presumed to have been extirpated from the sites, and are valued for economic or cultural reasons;
- soil seed banks, including seed banks of native species presumed absent, and potential for seed colonization from adjacent areas; and
- invasive, non-native species either present or which could potentially colonize the area.

P4. Assess direct and indirect ecological drivers causing or perpetuating degradation in the project sites and whether they are being addressed through effective management strategies, or if restoration activities are needed.

P5. Identify the main economic activities, livelihoods and sources of income for local communities and other stakeholders who might be affected by the restoration project.

P6. Assess direct and indirect socioeconomic drivers causing or perpetuating degradation in the sites and whether they have been resolved or are being addressed already, or if a parallel programme is required to remove these drivers. Evaluate the potential to reduce, mitigate or eliminate these human-caused stressors or threats.

P7. Identify key ecosystem processes and natural disturbance regimes.

P8. Identify any restrictions to implementing activities on the sites (e.g. sacred areas within Indigenous Peoples' territories that cannot be entered by non-Indigenous Peoples, critical habitat for vulnerable species in which activities are restricted). Some areas can only be entered after specific authorization or at some times of the year.

P9. Create a map of the project sites that identifies current use and ecosystem types, including successional stages, if relevant, priority recovery areas and areas that may require distinct restoration activities.

SC3 Assessment of landscape or seascape context

Every restoration project is embedded within a larger ecological, cultural and socioeconomic landscape or seascape, and conditions and activities within the broader geographical area can greatly influence the trajectory of recovery. For instance, an important factor in the recovery of all types of ecosystems is the degree of fragmentation of the broader landscape or seascape in which they are embedded, occurring either naturally or due to habitat conversion or degradation. Fragmentation affects connectivity and the flow of organisms or materials to and from the restoration site. Surrounding areas may allow for dispersal of propagules important to recovery but may also harbour threats (e.g. invasive species, pollutants). For this reason, it is critical to assess the biophysical (e.g. composition, structure, function and connectivity) and environmental (e.g. climate, disturbance) conditions at the landscape or seascape scale. Additional contexts to be assessed include: i) socioeconomic conditions (e.g. income and economic security, social resilience and health conditions, level of ecological awareness, and existing power relations and asymmetries); ii) stakeholders and rights and knowledge holders (e.g. types, interest and role in the project); iii) cultural and historical context (e.g. spiritual and cosmogonic beliefs and practices, cultural heritage values, folklore and folkways, and formal and informal land-use or sea-use agreements and rights); and iv) policy, governance and legal requirements (e.g. laws, regulations and policies that could support or hinder the project's implementation, sectoral policy differences, tenure policies, development or land-use plans that influence land-use and cover dynamics at the local level, and potential policy or legislative restrictions that might apply for planned interventions). Precise and thorough assessments can improve understanding of the issues that the project may need to address, as well as the types of activities that should be prioritized (e.g. reduction of pollution or unsustainable resource management, removal of contaminants, ecosystem services rehabilitation or ecological restoration).

Mixed-use fish-rice agroecological landscape within the Shan-Shui Initiative World Restoration Flagship in China

©Qingtian County Photographers Association, Zhejiang, China

While undertaking the context assessment, it is important to identify potential threats and future changes that may affect the project sites. Threats may include changes in environmental conditions (e.g. anticipated climate change or development), social conditions (e.g. possible changes in stakeholders and rights and knowledge holders involved) or policies (e.g. changes in laws or political realities). In addition, potential undesirable effects, problems, or limiting factors to the success of the project (e.g. planned infrastructure developments such as bridges, roads or large utilities, compensatory actions, and political instability and corruption) need to be considered and addressed. It is fundamental at this stage to analyse conflicts related to extractive industries, concessions and recent encroachment of lands by new actors, which often lead to displacement of people and ecosystem degradation. The context assessment process, however, should also consider and identify potential co-benefits (ecological, cultural, spiritual and socioeconomic) that may result from the project at the landscape or seascape scale and other positive outcomes generated by the restorative actions.

Information on the landscape and seascape context of the restoration project sites may be available from national or regional spatial prioritization plans that have been conducted to support restoration initiatives. These plans should be a starting point for the context assessment. If a landscape- or seascape-level spatial prioritization is not available for the area in which the project sites are located, it may be warranted to conduct one as part of project assessment.

P1. Obtain maps and information from landscape- and seascape-level spatial prioritization processes that were produced to support planning of restorative activities. If these do not exist in the area of the project sites, consider conducting a spatial prioritization process that is based on ecological, cultural and socioeconomic variables, and implemented with the engagement of stakeholders and rights and knowledge holders, including Indigenous Peoples and key groups.

P2. Assess the ecological and environmental conditions within the region in which the restoration project will be implemented, including identifying the composition and structure of ecosystems across the larger landscape and seascape, their level of vulnerability and overall landscape functions, including delivery of ecosystem services.

P3. Characterize fragmentation at the landscape or seascape scale, as well as its consequences for ecological and hydrological conditions and connectivity.

P4. Assess potential ecological threats from the larger landscape or seascape that may affect the restoration project sites.

P5. Assess the cultural, socioeconomic and governance factors that might support, limit, threaten or constrain the project, including spiritual, linguistic and historical considerations; legal and regulatory environment and customary laws and institutions; level of recognition of Indigenous Peoples' collective and customary rights; use and tenure of land, water and natural resources (SC8); sources of livelihood for stakeholders and rights and knowledge holders, and their capacities to be involved; and public perception.

P6. Assess potential land- and seascape-level co-benefits, transboundary effects or trade-offs that may result from the project.

P7. To the extent possible, identify and map potential future changes within the larger landscape or seascape. These may include changes in environmental conditions (e.g. extreme climatic events), social conditions, tenure management or the policy context.

SC4 Baseline monitoring

An assessment of the abiotic and biotic conditions of the project sites including the status of the key attributes of the restoration targets to be restored should be conducted in advance of implementation of restoration activities. This monitoring, which goes beyond the initial assessment of the site (SC2) and landscape or seascape (SC3) conditions, provides a benchmark for measuring change following restoration activities. For this reason, data-collection protocols and indicator variables used in the baseline monitoring optimally should match those that will be used for post-restoration monitoring and evaluation, as detailed in the monitoring and evaluation plan (SC36). This means that the monitoring and evaluation plan should be co-developed at the same time as the restoration plan, and the baseline monitoring should not be conducted until the complete monitoring and evaluation plan is in place.

The degree of detail required, and funds available to conduct the baseline monitoring, will vary among projects. Ideally, the baseline monitoring should assess multiple ecological, cultural, and socioeconomic indicators.

Participatory research for community-based fire prevention and peatland restoration in Bukit Batu, Indonesia

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P1. Measure multiple indicators of key ecosystem attributes (abiotic condition, species composition, ecosystem structure and function, external exchange and threats) and cultural and socioeconomic attributes. If feasible, include indicators of genetic composition and ecological connectivity. Selected indicators should match those specified in the monitoring and evaluation plan, as well as those that will be collected from reference sites, when available, or included in the reference model (SC5).

P2. Collect pilot data to determine required sample sizes as detailed in the monitoring and evaluation plan (SC39).

P3. Sample broadly across the project sites, to facilitate having data from areas that will be scheduled for each type of restoration activity as well as areas that are scheduled to be left untreated (to allow assessment of effects of restoration activities [SC39]), as part of the adaptive-management framework.

P4. Follow all protocols for data collection, as detailed in the monitoring and evaluation plan (SC40), to allow the baseline monitoring to be used as the benchmark for assessing restoration outcomes.

P5. Complete all aspects of the baseline monitoring before implementing any restoration activities.

P6. Maintain project records and information as detailed in the monitoring and evaluation plan (SC43).

SC5 Reference model

To determine the degree of ecological degradation on the project sites, it is useful to compare current site conditions to the condition that the project sites would be in if they had not been degraded, whether they be natural or managed systems. Although that undisturbed condition may no longer exist in the vicinity of the project, it can be characterized by developing a reference model. Reference models are most reliable when developed from multiple sources of information, including reference sites – sites that are environmentally similar to the project site, but that optimally have not experienced a high degree of degradation. A well-constructed reference model provides information on average ecological conditions and their variability at the project site (including species composition, ecosystem structure, key biological interactions and ecosystem functions). Other sources of information that can inform the reference model include ecological descriptions and successional models, climatic models, and historical information from natural and written archives. These sources of information may be particularly important for heavily modified landscapes, including urban areas or production landscapes, for which there may be an insufficient number of (or no) available reference sites. Care should be taken when using historical information, however, to avoid developing reference models that are appropriate for past time periods but lack relevance for modern ones. It may also be useful to develop projections of anticipated future reference conditions.

Identifying one or more reference models will help with multiple aspects of a restoration project. As mentioned above, the model can be used to determine the degree of degradation in abiotic condition, species composition, and ecosystem structure and function of the project site. In cases where project participants elect full ecological recovery (i.e. ecological restoration), the restoration goal will be to recover the site to within the range of variability found in the reference model. In other cases, the severity of degradation may preclude (financially or operationally) full recovery, or project participants may elect partial recovery or reclamation or an alternative productive land use. In these cases, the goal of the project would not be to achieve the reference condition, but rather a specified level of recovery of individual ecosystem attributes of the restoration targets. Finally, the reference sites used to develop the reference model can be resampled during monitoring of post-restoration activity for projects that include assessing the level of recovery of the restoration targets. Given that change is an inherent attribute of all ecosystems, even those that have not been degraded, the most reliable way to measure recovery is to compare contemporaneously collected information from project sites post-restoration with reference sites (SC39). This requires collecting data from reference sites during the same time periods when data is collected for the sites where restoration activities were implemented.

Saiga antelope (*Saiga tatarica*) on the Kazakhstan plains in the area of the Altyn Dala World Restoration Flagship

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P1.	Where available, identify sites that are in a similar environment as the project sites, but have experienced little to no degradation, to use as potential reference sites. In some cases, reference sites may be available in protected areas exposed to little degradation or that have recovered through effective restoration. It is important to explain the reasons for selection of reference sites. Georeferencing these sites is helpful for future relocation so that they can be used for monitoring and evaluating the degree of recovery of the area being restored.
P2.	Measure multiple indicators for key ecosystem attributes (abiotic condition, species composition, ecosystem structure and function, external exchanges and threats) that will be used to characterize the reference model. If necessary, include indicators of genetic composition for species of high interest or that are highly endangered, as well as habitat connectivity. These indicators should match those specified in the monitoring and evaluation plan and collected during the baseline monitoring.
P3.	Sample reference sites for selected indicator variables, using the protocols identified in the monitoring and evaluation plan.
P4.	For a subset of potential reference sites, collect pilot data on each indicator variable to determine the required number of reference sites that need to be assessed to reliably estimate mean conditions and ranges of variability.
P5.	Use summary statistics (including means, ranges and variance) for each indicator variable to develop the reference model.
P6.	In addition to data from reference sites, include in the development of the reference model all types of knowledge about the condition that the project site would have been in if it had not been degraded, including knowledge from practitioners, experts, and stakeholders and rights and knowledge holders, including key groups and Indigenous Peoples (following FPIC). Potential sources of information include descriptions of ecosystems with high (or relatively high) ecological integrity, environmental agency guidelines, sector-specific standards, successional models or historical information. These other sources of information are particularly important in areas where reference sites do not exist anymore.
P7.	Evaluate whether the project sites require more than one reference model. Multiple models may be needed for projects that include more than one ecosystem or productive land-use type, where multiple alternative ecosystem states may arise from succession, or where climatic factors may lead to uncertainty in future conditions.

Surveying within the Nelder Plot Experiment in the Democratic Republic of the Congo

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Harvest of moringa (*Moringa oleifera*) in the Niger, following restoration activities implemented under the Great Green Wall World Restoration Flagship

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PLANNING AND DESIGN

Effective planning is essential to achieve desired outcomes of ecosystem restoration and, therefore, the development of a restoration plan underpins the entire restoration process. The plan should be a product of informed decision-making at all levels and be developed through a participatory process that includes all stakeholders and rights and knowledge holders involved in, or affected by, the restoration, as well as experts in ecosystem degradation and repair (SC6). The development of a shared vision and the identification of restoration targets (ecological, socioeconomic or cultural elements on which the project has chosen to focus), as well as specific restoration goals and objectives (SC7), should be built on fair and transparent negotiations to address potential conflicts or trade-offs among goals, objectives and activities in a manner that aims to optimize ecosystem recovery.

Restoration planning is complex and requires an understanding of land and resource tenure security, legitimate tenure rights and cultural values (SC8), which may be closely interrelated (e.g. Indigenous Peoples' tenure). Development of clear agreements among stakeholders and rights and knowledge holders on the project governance structure and decision-making processes (SC9) is also essential. Capacity development (SC10) is likely to be needed to enable and enhance participation of stakeholders and rights and knowledge holders, including key groups and Indigenous Peoples, in selecting and prioritizing restoration activities (SC11), and to achieve consensus among local actors and authorities as to funding, access, adaptive management and other aspects of project implementation. By prioritizing the types of restoration activities to be implemented, the project can be scaled to available resources or adjusted if external factors require that changes be made. The adoption of an adaptive-management framework (SC12) allows activities to be designed and implemented in a manner that allows assessment of outcomes and application of findings to improve the project.

Development of the restoration plan (SC13) should be based on the condition of the project sites, including anticipated conditions resulting from climate change, and the key attributes of their restoration targets, as determined in the assessment component. The plan should specify all details about the project (SC6 to SC12), including plans, timelines and required financial resources and in-kind contributions (SC14) for baseline monitoring (SC4) and the development of the reference model (SC5), as well as practices within the implementation, ongoing management, and monitoring and evaluation components. The plan should also detail the laws and regulations (SC15) that must be followed to enable implementation activities. Because issues may arise during implementation that can adversely affect restoration outcomes, appropriate risk assessment and management (SC16) need to be conducted to anticipate, prevent, reduce or mitigate these adverse effects. Information management and record-keeping (SC17) are also critical during planning and design to enable broad engagement, understanding of the planned restoration and ongoing management activities, and adaptive management. Finally, an effective communication strategy (SC18) can help expand the reach of the shared vision and plan, build trust and avoid problems related to project governance and design.

BOX 3. INDIGENOUS PEOPLES' CONSIDERATIONS IN PLANNING AND DESIGN OF ECOSYSTEM RESTORATION PROJECTS

Effective ecosystem restoration is possible only when stakeholders and rights and knowledge holders, including key groups and Indigenous Peoples, are able to freely participate in the planning and design of restoration projects. Indigenous Peoples, in particular, have food and knowledge systems that have been established over many centuries based on tangible and intangible cultural knowledge and practices. Such knowledge systems and practices have proven to be substantial and fundamental in ecosystem restoration activities. By paying attention to the traditional notions of Indigenous Peoples as webs of social interaction tied to place, history and identity, their sociocultural values can be appropriately integrated into the planning and design of restoration projects. Indigenous Peoples have accumulated comprehensive knowledge to avoid, reduce or reverse degradation of land and marine areas, and this should be reflected in ecosystem restoration plans. Practices maintained and developed by Indigenous Peoples reflect long histories of positive interaction with and understanding of their ecosystems (including elements such as seasonality, weather and use of native crops to avoid soil or marine degradation). These practices are sustainable and environmentally friendly. By incorporating different understandings of land and sea management, stakeholders and rights and knowledge holders can support broader visions for restoration.

Unfortunately, Indigenous Peoples are often neglected in the planning and design of restoration activities and often are only consulted after plans and activities have been defined and agreed upon. Inclusion of Indigenous Peoples in the early stages of planning and design will reduce the likelihood of later difficulties and will improve restoration effectiveness by enabling participation of people who may live closest to project areas (which are often important biodiversity areas), who have deep knowledge about conservation and stewardship, and who may be in the best position to promote or maintain the restoration over time.

Ecosystem restoration planning and design must recognize the collective rights of Indigenous Peoples, including their rights to lands, territories (marine and terrestrial), and resources in accordance with Articles 3 and 26 of the 2007 United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP)[4] and the International Labour Organization's Indigenous and Tribal Peoples Convention (No. 169). Planning and design must be done in accordance with tenure rights (including customary and collective rights), which are fundamental for Indigenous Peoples, who live in, manage and own large areas of remaining undegraded ecosystems. Indigenous Peoples' tenure systems are fully aligned with their overall social, economic, cultural and spiritual contexts and views. Customary and collective land rights vary significantly across Indigenous Peoples' communities depending on their locations, social organizations and modes of livelihood. For some of these communities, land and natural resources may be collectively owned and used, and are often managed on an egalitarian basis. Thus, it is essential to understand who has rights over the targeted area of the project both under governmental and customary rights law. Indigenous Peoples are often vulnerable to tenure disputes over land and resources because of their customary tenure systems. Lands and rights defenders often face violence and death as a result of the desire of extractive industries to exploit resources within Indigenous Peoples' territories. Furthermore, in most territories, in addition to governmental administrative systems and authorities, there are ancestral governance systems, self-determined development mechanisms and leaders that play an essential role in the community. In many cases, project managers favour governmental administrative channels and authorities and overlook existing ancestral governance and community leaders. However, recognition, respect and consideration of Indigenous Peoples' governance systems and leaders are required for achieving a long-term commitment of Indigenous Peoples to the restoration project. Furthermore, it improves understanding of their contributions and needs.

Ecosystem restoration planning and design must also consider funding for Indigenous Peoples' contributions to restoration projects. As guardians of biodiversity, Indigenous Peoples provide ecosystem services to the world through their territorial management and food systems. Paradoxically, they tend to be kept away from both national and international financial mechanisms to support their systems, work and services provided. Making financial resources accessible to Indigenous Peoples will both support and incentivize their communities and improve the outcomes of restoration initiatives. Sustainable financing initiatives can allow active engagement of Indigenous Peoples and mitigate the factors that might hamper restoration (e.g. immediate subsistence needs). Financing should include support for activities throughout the restoration process, including pilot studies, data collection, and monitoring and adaptative management beyond the lifespan of the project.

Throughout planning and design, care must be taken to protect Indigenous Peoples' knowledge, interviews and cultural expressions, including songs, oral histories or stories, ceremonies, dances, and other texts, images and recordings. Risk of unauthorized appropriation is a primary impediment for Indigenous Peoples to share their vast knowledge about foods, medicines and ecosystems. Consequently, it is important in planning and design to uphold the free, prior and informed consent (FPIC) of Indigenous Peoples and to ensure their data sovereignty and respect their decisions on knowledge sharing. Planners and designers must consider, in an ethical way, collectively agreed protocols of Indigenous Peoples for accessing and sharing their knowledge (including open exchange, production and dissemination), and acknowledge the potential risks of sharing their knowledge.

As appropriate, Indigenous Peoples' voices should be included and promoted in communication plans and strategies, particularly the voices of youth, who are often active and interested in adopting innovative approaches. This can be achieved, for example, through press releases, social media, educational activities, and other awareness-raising strategies.

View of Ha'atafu Beach, Tongatapu Island, Tonga, Polynesia

©Shane Orchard

PLANNING AND DESIGN

SC6 BROAD ENGAGEMENT
SC7 VISION, TARGETS, GOALS AND OBJECTIVES
SC8 LAND AND RESOURCE TENURE
SC9 GOVERNANCE
SC10 KNOWLEDGE AND CAPACITY
SC11 PRIORITIZATION OF AREAS AND ACTIVITIES WITHIN SITES
SC12 ADAPTIVE MANAGEMENT
SC13 RESTORATION PLAN
SC14 FINANCING
SC15 LAWS AND REGULATIONS
SC16 RISK ASSESSMENT AND MANAGEMENT
SC17 INFORMATION MANAGEMENT AND RECORD-KEEPING
SC18 REPORTING AND COMMUNICATION

SC6 Broad engagement

Restoration planning should recognize and consider the interests, rights, roles and responsibilities of all stakeholders and rights and knowledge holders, including Indigenous Peoples and key groups, identified in the assessment component, who are interested in and directly or indirectly affected by the restoration activities (including at local, regional or national levels). Doing so will improve understanding of the needs and concerns of all interested parties, and will help design strategies to build on common interests and negotiate potential differences, all of which improve long-term impact. This engagement is particularly vital when operating at large spatial scales (i.e. landscape or seascape scale), where stakeholders and rights and knowledge holders are likely to hold different views and have diverse (and often competing) interests, and where there is likelihood of conflicting uses and rights. For this reason, throughout the entire planning and design component and the full cycle of the project, relevant stakeholders and rights and knowledge holders should be encouraged to be active participants. However, appropriate levels of engagement generally vary with the actors responsible for the project (e.g. government agencies, Indigenous Peoples, land users). When multiple actors are involved, it is important to recognize cultural, class, gender and power differences, and rights and responsibilities, and to promote inclusivity and empowerment of participants in the decision-making process. Free, prior and informed consent is required when engaging with Indigenous Peoples. A skilled facilitator can help manage stakeholder and rights and knowledge holder processes by carefully allowing all voices to be heard and creating respectful processes to address conflicts. Communications for planning, education and informational purposes should address local languages and literacy levels to facilitate understanding of the process and the importance of restoration.

P1. Identify and build relationships with key local leaders to develop trust with stakeholders and rights and knowledge holders.

P2. Ensure enabling conditions for all stakeholders and rights and knowledge holders to participate, especially Indigenous Peoples and key groups, considering their languages, literacy levels, and possible power, cultural or social asymmetries. This will ensure alignment of restoration objectives with local needs and aspirations.

P3. When needed, enhance capacities (i.e. knowledge, competencies and skills) of project participants, including stakeholders and rights and knowledge holders, to facilitate their involvement, promote a shared understanding of restoration, foster partnerships and collective action throughout the restoration process, and improve trust among groups.

P4. Consider the socioeconomic and political dynamics (including gender, age and other power dynamics) to ensure that all stakeholders and rights and knowledge holders are transparently engaged and have a say in the restoration from planning to monitoring and evaluation, and that they are aware of the expected actions, benefits and responsibilities. This will take time but will build fundamental trust, openness and a shared purpose, and help prevent conflict in later stages.

P5. Build an inclusive and transparent partnership such that stakeholders and rights and knowledge holders are represented and that participatory processes are integrated throughout the full project lifetime and possibly beyond for ongoing management. This will enable better governance and communication, and improve collaborative development on an agreed action plan and transparency around benefit sharing. A collaborative partnership also is likely to aid fundraising and be seen as less risky by investors.

P6. Co-create a shared understanding and vision for the restoration project, considering the potential for trade-offs due to different views or agendas, by working closely with stakeholders and rights and knowledge holders to understand their full needs and desires, their uses of the landscape or seascape, and their perceptions about the causes of degradation.

P7. Support stakeholders and rights and knowledge holders in sharing and applying their knowledge and experience to making key planning decisions including, in particular, the definition of restoration targets, goals and objectives (SC7), and development of the restoration plan.

P8. Consider cultural, spiritual, educational, recreational and historical values of the ecosystem in setting restoration targets, goals and objectives, and defining restoration activities. This is important to enhance socioeconomic, cultural and spiritual, and ecological values, recognizing that people attach meaning to place.

P9. Co-develop a strategy for continuous engagement to enable the development of a joint project vision and buy-in, considering that there might be a need for compromise or trade-off due to differing concerns and expectations of stakeholders and rights and knowledge holders.

P10. Work with stakeholders and rights and knowledge holders and their different types of knowledge and address any possible conflicts between cultural (including identified cultural heritage and spiritual values of the project area) and ecological values, before the planning process proceeds.

P11. Co-develop a joint and inclusive agreement on the roles and responsibilities of stakeholders and rights and knowledge holders for decision-making.

P12. Co-develop policies for collecting and managing data (including quantitative and qualitative data derived from all types of knowledge, including local, traditional, practitioner, scientific and Indigenous Peoples' knowledge), respecting intellectual property rights and securing consent for data sharing as appropriate. These policies should be included in the project's data and information management plan (SC17).

P13. Guarantee FPIC when engaging with Indigenous Peoples involved with or affected by the restoration project. Consider that FPIC agreements must be mutual and recognized by all parties, taking into consideration customary ways of decision-making and consensus seeking.

P14. Explore participatory methods for engaging Indigenous Peoples, respecting their rights, including collective and customary rights, in order to shape discussion and generate a rich understanding of the connections between people, Indigenous Peoples' cosmogony, belief systems, places, organisms and organizations over space or time.

P15. Wherever educational activities are possible, encourage awareness raising, capacity development and knowledge exchange (e.g. intergenerational) among stakeholders and rights and knowledge holders in ways that lead to tangible behavioural change that improves ecosystem integrity and ecological, cultural and socioeconomic resilience.[a]

[a] Aspirational practices are denoted with colored shading behind the text throughout the *Standards of practice*.

SC7 Vision, targets, goals and objectives

A shared project vision provides an aspirational picture of the desired condition of the project site sought by stakeholders and rights and knowledge holders. Once this vision is jointly defined, specific ecological, cultural and socioeconomic restoration targets can be determined. These targets are the ecological (i.e. attributes of ecosystem integrity) and cultural or socioeconomic elements on which the project will focus. All targets should collectively represent the agreed-upon vision for the restoration project and the project focus. For each restoration target, the project should have one or more goals that indicate the long-term ecological, cultural and socioeconomic outcomes and degree of recovery to be achieved. Cultural and socioeconomic goals are associated with benefits (e.g. ecosystem services) accrued during restoration that generally require achievement of the ecological goals. Each goal should have one or more objectives that indicate what is to be achieved by the restoration process in the short to medium term, in order to achieve the long-term restoration goals. Information obtained during the assessment of project site conditions (SC2), and possibly development of a reference model (SC5), should be used to inform the development of goals and objectives for each restoration target. Project sites are often chosen to be restored to improve provision of ecosystem services. Understanding and identifying this motivation for restoration and its importance early in planning allows the development of an integrated restoration plan. Possible trade-offs should be evaluated to avoid net gain in some targets and net losses in others.

Community Ocean Forum initiated by Demak communities as part of the Building with Nature World Restoration Flagship in Indonesia

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P1. Develop a written statement, drawing or model that describes the overall vision and why the project is taking place, with descriptions of the desired benefits to nature and people.

P2. Identify the ecological (i.e. biodiversity and other key attributes of ecological integrity), cultural and socio-economic (e.g. ecosystem goods and services) targets of the restoration project (collectively the restoration target). Prioritize and select those that will be the focus of the project whether for natural ecosystems or production systems.

P3. Identify the restoration goals and objectives (desired outcomes of restoration activities) by comparing the restoration site baselines against the desired conditions for short-, mid- and long-term time periods, or against the reference model, when appropriate (e.g. for ecological restoration).

P4. When developing restoration goals and objectives, aim for the highest level of recovery possible for biodiversity, ecosystem integrity and human well-being, given the limitations imposed by resources available and extent of degradation that has taken place.

P5. Define restoration goals for long-term periods and related objectives for short- to medium-term periods that are scientifically valid, technically feasible, economically viable and socially acceptable.

P6. For each goal and objective, specify the degree of ecosystem recovery anticipated in a manner that is specific, measurable, achievable, results-oriented, and time-limited, or "SMART". There may be multiple objectives for each goal.

P7. Use the ecological, cultural and socioeconomic goals and objectives to set the basis for monitoring.

SC8 Land and resource tenure

Clear and secure land and resource tenure is critical for ensuring the sustainability of ecosystem restoration efforts, reducing disputes over ownership and resource control or rights, avoiding environmental degradation and, ultimately, decreasing investment risk and increasing net gain for nature and people. Although securing tenure of land and natural resources may fall outside the scope of the restoration project, project implementers must consider and respect legitimate tenure rights in restoration planning. Investment in restoration efforts in areas where land and resource tenure and rights are clear and secure from threats for the foreseeable future is likely to provide the greatest net gain to people and nature. Prevention of tenure disputes may avoid potentially costly conflicts over restoration. When possible, agreements or contracts should be made to safeguard restoration activities into the future. Alternatively, specific actions might be included in the restoration plan to help address tenure insecurity or tenure conflicts (e.g. by establishing a redress or grievance mechanism) to increase the sustainability of the restoration, particularly for Indigenous Peoples and key groups.

P1. Determine land and resource tenure context prior to planning restoration activities, to understand i) the types of tenure system (public, private, communal, Indigenous, customary or informal); ii) who has access to resources, for how long and under what conditions; iii) how actual rights are influenced by tenure security and land governance characteristics; iv) if tenure rights are secured and how their security affects degradation; and v) existing or potential conflicts over natural resources.

P2. Ensure that land and resource tenure and rights of stakeholders and rights and knowledge holders are understood and respected throughout the restoration process and provide meaningful and informed involvement to legitimate tenure rights holders and knowledge holders in reviewing the process. This may include protecting the legitimate tenure rights of Indigenous Peoples and other rights holders with customary tenure systems, according to existing obligations under national and international law.

P3. Recognize the ecological, cultural, spiritual, socioeconomic and political value of land and water resources to Indigenous Peoples and key groups with customary tenure systems.

P4. Promote effective participation by Indigenous Peoples and other rights holders in decisions regarding their tenure systems through their local or traditional governance institutions.

P5. As appropriate, establish contractual agreements on restoration efforts with land users, managers, stakeholders and legitimate tenure rights holders. Try to ensure that these agreements prevent future changes in use that would jeopardize restoration efforts and investments.

P6. Promote equitable, secure and sustainable rights to land and water resources in customary or collective tenure systems, with special attention to the provision of equitable access for Indigenous Peoples and key groups.

SC9 Governance

Governance includes formal (legal and regulatory systems) and informal (social, community organization, Indigenous People's practices and traditions) institutions and their rules. Effective restoration projects require a governance structure that is open, transparent and inclusive (usually labelled as adaptive ecosystem or environmental governance). The form of governance will vary among projects, due to the wide range of actors that engage in restoration, such as Indigenous Peoples, land users, non-profits and governments. However, whenever applicable, project governance should be participatory and inclusive of all stakeholders and rights and knowledge holders. Key aspects of participatory governance include accountability, efficiency, effectiveness, fairness and equity, inclusiveness and transparency, as well as sustainability, social learning and adaptability. Examination of best practices used in governance of other restoration projects and programmes may help identify the most effective governance structure applicable to the project's scale (local, subnational, national or transboundary) and the types and numbers of actors that may be participating. Governance should also be adaptive to deal with changes and results, and to allow for adjustment or revision of the vision and goals of the project.

Achieving agreement among stakeholders and rights and knowledge holders on how the project will be governed is an important initial planning step. Without a clear understanding of, and agreement on, the governance structure and decision-making processes, misunderstandings about roles and responsibilities could put the project at risk. An appropriate mechanism for addressing disputes should be developed.

P1. Define, establish or co-create inclusive and participatory governance (structure, mechanisms and arrangements) that will be the most appropriate for the restoration project, considering timelines and project goals.

P2. Ensure representation of stakeholders and rights and knowledge holders in decision-making processes.

P3. Define a clear and accessible grievance redress mechanism that outlines focal points, procedures and timelines to address complaints and grievances in an impartial, confidential, transparent, timely, effective and culturally appropriate way to all stakeholders and rights and knowledge holders, especially Indigenous Peoples, key groups and those who may face barriers such as a lack of fluency in the language of the plan, illiteracy, lack of awareness or fear of reprisal. Customary dispute-resolution mechanisms used in the area of the project site should be respected.

SC10 Knowledge and capacity

Practitioners and implementers, including stakeholders and rights and knowledge holders involved in restoration projects, need to have adequate skills, competencies and knowledge to ensure the delivery of expected outcomes and impacts. Thus, it is necessary to identify existing skills, knowledge and competencies, as well as gaps, among project participants according to their anticipated roles and responsibilities during the restoration process. Conducting a capacity-needs assessment to identify gaps is crucial for determining the actions necessary for developing capacity. Actions might include, for example, development of training programmes for practitioners and other implementers, and professional certification.

Capacity-development strategies should also contribute to: i) empowering stakeholders and rights and knowledge holders, including Indigenous Peoples and key groups, to be actively involved throughout the restoration process, and reducing social asymmetries that impede inclusive and equal participation; and ii) integrating and building on knowledge and restoration practices from Indigenous Peoples and key groups at the local level. Approaches to capacity development will need to be tailored to differences in language, culture and ways of communication and to differences in handling and incorporating information. This inclusivity will support the improvement and expansion of planned restoration activities to better achieve desired outcomes. Different strategies to address capacity gaps and needs may be required (e.g. formal training, experiential learning).

P1. Assess technical capacity needs and gaps according to roles and responsibilities of project participants.

P2. Address capacity gaps by providing practitioners, other implementers, and stakeholders and rights and knowledge holders with opportunities for dialogue, trainings or engagement in restoration networks and communities of practice that can provide knowledge about appropriate practices from lessons learned from similar projects. Consider local languages and literacy levels when addressing capacity gaps. Provide interpretation for all stakeholders and rights and knowledge holders, including Indigenous Peoples and key groups, and schedule activities in their proposed locations and use cultural mediation to foster true dialogue.

P3. Promote mutual learning and knowledge sharing among practitioners, other implementers, and stakeholders and rights and knowledge holders about effective practices and innovative approaches, to develop, adapt and replicate successful experiences, and to avoid repeating mistakes.

P4. Incorporate all types of knowledge, including local, traditional, practitioner, scientific and Indigenous Peoples' knowledge into capacity-development plans and activities.

P5. Ensure that practitioners, other implementers, and stakeholders and rights and knowledge holders recognize the internal and particular rules (including norms and conditions) under which Indigenous Peoples will exchange their knowledge, as well as other rules determined collectively by them.

SC11 Prioritization of areas and activities within sites

Once the goals and objectives for the restoration targets have been agreed upon, the areas of the sites where restoration activities will be conducted and the proposed restoration activities must both be carefully considered to achieve the highest level of recovery possible given the project's vision and goals, and to support efficient allocation of available resources (finance, human and time). Projects may contain areas with differing levels and types of degradation. Given that it may not be possible or desirable to implement restoration activities across the entire project sites, or that treatments may need to occur sequentially over time, it is critical to strategically prioritize the areas to be treated. Information from existing landscape- and seascape-scale spatial prioritizations and project assessments may be useful for determining the locations where specific activities are to be undertaken within the project sites. In some cases, priority may be given to areas that are highly degraded if they pose health or ecological hazards or can be recovered within project budgets. In other cases, priority may be given to areas that can lead to greater ecological, cultural and socioeconomic benefits in the short term. When resources are limited, it may be appropriate to focus on lightly or moderately degraded areas where achieving success is likely or where restoration may be most cost-effective. This may allow restoration efforts to go further despite resource limitations.

In addition to prioritizing the locations within sites in which to implement activities, it is also necessary to prioritize the types of activities that will be implemented (SC24, SC25 and SC26), with the aim of selecting the restorative activities that achieve the greatest net gains possible for biodiversity, ecosystem integrity and human well-being (i.e. as far to the right as feasible on the restorative continuum; Figure 2). Activities should be tailored to the specific ecosystem type, level of degradation, and ecological, cultural or socioeconomic values. In addition, prioritization of activities should be based on available evidence about the reliability of restoration activities. Where sufficient information about appropriate restoration approaches is unavailable, it may be necessary to implement preliminary work (e.g. pilot activities) to determine the best approach to restoration (e.g. arranging plantings in clumps versus dispersed across the site). In addition, it is critical to identify the most cost-effective restoration activities (including eliminating threats or barriers to recovery) necessary to achieve the highest level of ecosystem recovery possible given the project's vision and goals. Information about the efficacy and costs associated with restoration activities may be available either locally from experts including practitioners and other implementers, or from existing guidance documents, knowledge platforms and restoration networks. Prioritization of activities can be improved by integrating all sources of existing information into the prioritization process.

Project planning with community members for the Building with Nature World Restoration Flagship in Indonesia

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P1. Use information (ecological, cultural and socioeconomic) from landscape- and seascape-level spatial prioritization processes and project assessments to inform the selection of areas to be restored and prioritization of restoration activities for those areas. Tools such as integrated cost–benefit analysis or multicriteria spatial optimization, where ecological, cultural and socioeconomic aspects are examined, also aid in identifying site-level priorities.

P2. Conduct a review of existing local, national or international standards and guidelines to inform decision-making and selection of best restoration activities.

P3. Consult with experts including practitioners and other implementers, as well as databases, knowledge platforms and restoration networks to identify effective practices to implement planned restoration activities (e.g. elimination of barriers to natural recovery processes, enhancement of growth and survival of desirable species).

P4. Consider developing alternative scenarios for how the restoration might be conducted, the resources required and the expected outcomes. Such scenarios should incorporate anticipated changes in ecosystem structure and function and threats, and reflect the likely effects of climate change.

P5. Integrate into restoration plans existing effective Indigenous Peoples' practices of restoration, as well as other traditional practices. The anticipated activities, benefit sharing, and roles and responsibilities should be clearly described.

SC12 Adaptive management

During project planning, project managers, practitioners, implementers, and stakeholders and rights and knowledge holders should i) acknowledge uncertainty about the ecological, cultural and socioeconomic aspects of ecosystem restoration, ii) document assumptions that underpin management decisions, and iii) build tests of assumptions into the project design. In other words, restoration activities should be planned and designed in a manner that promotes learning about their efficacy and effects on ecological, cultural and socioeconomic conditions. In addition, it is essential that during the project planning process, stakeholders and rights and knowledge holders recognize the need for flexibility in the project, should major changes be required based on lessons learned. It is also critical to build an adaptive-management framework during planning to allow for budgeting of adequate financial and human resources for essential tasks. For instance, budgeting for facilitation is particularly important for ensuring wide and effective stakeholder and rights and knowledge holder participation, dialogue and negotiation (SC6). When appropriately integrated into project planning and design, an adaptive-management framework allows for continuous improvement and builds on restoration objectives to advance initial recovery towards restoration goals, which increases the potential to achieve the highest level of recovery possible over the long term.

P1. Get agreement among all stakeholders and rights and knowledge holders involved in the project on the adoption of an adaptive-management framework that includes effective monitoring and evaluation.

P2. Use information from the project assessment component and other knowledge to document uncertainty and assumptions about the condition of the sites, restoration goals and objectives, and restoration activities.

P3. Build explicit tests of assumptions and restoration outcomes into the project design, either by implementing pilot activities (such as treating a small portion of the project sites before implementing activities more widely) or by testing multiple restoration alternatives against a no-action or untreated control.

P4. Ensure that the monitoring and evaluation plan (SC36) is developed during project planning and designed specifically to test uncertainties and assumptions about the implementation, effectiveness and effects of management activities from ecological, cultural and socioeconomic standpoints.

P5. Develop budgets and timelines for activities associated with application of monitoring and evaluation results so that relevant tasks do not get overlooked, and to maximize the benefits of the monitoring and evaluation effort.

P6. Establish a process for reviewing the restoration plan (SC13) to incorporate new knowledge or respond to changing ecological, cultural and socioeconomic conditions and lessons learned from monitoring and evaluation.

SC13 Restoration plan

A well-developed restoration plan will contain all the elements necessary to document, justify, implement, monitor and evaluate, and adaptively manage a restoration project. It guides the entire restoration process, from the baseline monitoring in the assessment phase, to project implementation, ongoing management, and monitoring and evaluation. This plan should provide the specific details of the project, from the spatial boundaries of the restoration sites to the project's timeline and resources, ecological, cultural and socioeconomic targets, goals and objectives, and procedures for managing and sharing information. Development of the plan provides an opportunity to synthesize all assessment information including local, traditional, practitioner, scientific and Indigenous Peoples' knowledge; the values, needs and desires of stakeholders and rights and knowledge holders; approaches to implementation and its prioritization; anticipated outcomes; evaluation through monitoring; and the adaptive-management approach and protocols for plan modification.

Stakeholders and rights and knowledge holders should participate in co-developing the restoration plan, building as far as possible on effective local, traditional, practitioner, scientific and Indigenous Peoples' restoration practices. A draft plan should be reviewed by stakeholders and rights and knowledge holders to ensure that it aligns with their aspirations, restoration best management practices, long-term management capabilities and land-use planning. Restoration plans should be considered as "living" documents that will change and evolve over time.

P1. Include in the restoration plan:

- a description of the sites to undergo restoration based on the site and landscape or seascape assessments, the project vision and restoration targets, and a rationale for doing restoration work;
- measurable restoration goals and objectives and any performance standards;
- explicit plans, maps, schedules and budgets for restoration activities, including plans for contingencies;
- plans and procedures for implementation and ongoing management activities (including their description, duration and frequency);
- the monitoring and evaluation plan, including procedures, schedules and budgets; and
- a detailed data and information management plan.

P2. Develop an implementation calendar that estimates the project timeline with the specific restoration activities and their costs. Some restoration activities may be done simultaneously, whereas others will have to be conducted sequentially (e.g. substrate amendments prior to translocation).

P3.	Base the plan on all types of knowledge, including local, traditional, practitioner, scientific and Indigenous Peoples' knowledge. Follow FPIC for integrating Indigenous Peoples' knowledge and take care to avoid inequitable exploitation of it.
P4.	When the efficacy of particular restoration activities is uncertain, test multiple alternative restoration activities to learn what works and what does not (to allow for adaptive management).
P5.	Solicit review of the restoration plan from stakeholders and rights and knowledge holders, independent practitioners, scientists and other experts; and modify the plan as appropriate based on inputs and feedback.

SC14 Financing

Securing adequate financial resources during project planning and design for all components of restoration is essential for successful outcomes. To do this, it is critical to mobilize diverse sources of funding, including government, private and official development assistance. The necessary amount and type of funding (e.g. cash, in-kind contributions), however, will vary with the size of the project and the types of activities required. In some cases, required actions for recovery may be limited to removing the cause of degradation, which could be done through changes in management (e.g. stopping cattle from overgrazing), regulatory disincentives (e.g. fines) or market incentives (e.g. subsidies for use of alternative crops or pasture management). Costs typically are higher when restoration requires intensive changes to the physical sites or translocation of organisms (e.g. production, collection or purchase of seeds or other propagules; breeding facilities to initiate coral development).

Where feasible and desirable, opportunities may be explored to mobilize finance through the development or strengthening of sustainable value chains. This includes financing restoration through the sale of products and services that result from restoration activities and facilitating access to markets for such products and services. This will also open the possibility of (co-)financing investments in restoration activities with private entities, which in turn could help fulfil local socioeconomic needs through the diversification of livelihoods, promoting inclusion, sustainability and resilience. Most restoration activities take significant time to achieve their goals. Therefore, strategies to ensure long-term financing may involve payment for ecosystem services (e.g. clean water) and the development of sustainable bankable businesses linked to restoration activities. In such cases, care must be taken to prevent further degradation and compromise ecosystem recovery. For projects that can be phased in over time, consideration of different types of financing and capacity needs for subsequent phases should be considered. When different restoration projects are in close spatial proximity, opportunities may exist to coordinate across these efforts to reduce costs and secure funding.

After identifying possible sources of funding, an itemized budget should be included in the restoration plan. The budget should include all activities in all components of the restoration project, including broad stakeholder and rights and knowledge holder engagement, information management and record-keeping, and communication and reporting, which are often overlooked in budgeting for restoration. Similarly, restoration budgets often do not include adequate funding for monitoring and evaluation and use of findings for adaptive management. Inclusion of details for these subcomponents of restoration in the restoration plan will facilitate developing appropriate budgets. Additionally, budgets should be flexible or include discretionary funds that could be applied to accommodate any required changes in restoration activities that arise from adaptive management.

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Harvest of Oujiang color carp (*Cyprinus carpio* var. *color*) from a fish-rice agroecosystem within the Shan-Shui Initiative World Restoration Flagship in China

P1.	Develop a project budget specific to the project vision, targets, goals, objectives and time frames.
P2.	Establish project budgets that reflect all costs associated with assessment, planning and design, implementation, ongoing management, and monitoring and evaluation, including compensation or incentives for land users or communities, materials and labour, and, as necessary, capacity-development activities.
P3.	Ensure adequate funding is available for adaptive management and subsequent modifications to the restoration plan, implementation activities, and monitoring and evaluation.
P4.	Explore where and what restoration activities can be linked to the development of sustainable value chains and identify potential markets for commercialization. Safeguards should be in place to ensure that such linkages do not cause further degradation within or outside the project area.
P5.	When appropriate, enhance access to sustainable markets for the commercialization of goods and services derived from the restoration activities, through capacity development, credits and infrastructure.
P6.	Determine appropriate sources of funding, in the long run, if not already secured. In addition to typical funding sources (e.g. governments, non-profits, businesses), small projects might consider crowdfunding and larger projects payment for ecosystem services. Diversification of funding sources may allow long-term sustainability and reduce investment risk.
P7.	Coordinate with other restoration projects to reduce costs by reducing duplication of effort. Synergies could include, for example, planning, sourcing of plant materials, sharing costs of equipment, and monitoring.

SC15 Laws and regulations

All human activities are subject to laws and regulations, both formal and customary, that set standards of acceptable behaviour and basic rights, and ideally promote peace, justice, equity and safety in society. Although laws and regulations may not be perfect or fair, at the very minimum, they establish explicit rules of conduct. Compliance with laws and regulations is expected to minimize conflict and loss. Restoration projects include activities that affect people and communities, and the landscapes and seascapes, ecosystems and species on which they rely. As such, projects are typically governed by laws and regulations, from local to national, that address tenure, use and protection of land, water and natural resources, and that determine social and environmental rights. They may even include transboundary laws and regulations to address, for example, invasive species within large-scale projects that involve two or more jurisdictions. Planning requires a clear understanding of the laws and regulations that apply to the specific restoration project. In some cases, complying with a law involves relatively simple actions, like obtaining a permit or complying with professional certification laws; in others, such as when engaging with Indigenous Peoples, there are complex requirements (e.g. obtaining FPIC, informing relevant customary authorities, and respecting their land tenure systems and collective and customary rights), some of which can be oral.

P1. Identify the national and subnational laws and regulations that apply to the project. These may include requirements for permits; protection of vulnerable species and ecosystems; laws specific to restoration, compensation or environmental remediation; customary and collective rights of rights and knowledge holders, including land tenure and rights to natural resources; and labour and personnel safety laws.

P2. Map sector-specific governance requirements and adopt all relevant rules, regulations and policies. For instance, for seed supply chains, determine the permits and approvals required (including, for example, phytosanitation certificates), resource allocation and background information necessary for those permits, and obtain them.

P3. Request all necessary permits and other measures of compliance with relevant laws and regulations, based on the practices described in P1 and P2. Determine if subsequent changes to the project will require amendments to any permits. When appropriate, approval for human subject research should be obtained.

P4. Ensure that conflicts among regulations from different jurisdictions (e.g. governments, agencies, Indigenous Peoples, local communities) and sectors (e.g. energy, development, infrastructure, sustainability, conservation) are identified and resolved with an explicit statement that defines a policy regarding the project.

P5. Ensure that budgeting of personnel and financial resources allows for compliance with occupational work and labour laws and regulations.

P6. Compile a personnel manual that informs practitioners and implementers of all the relevant work, health and safety codes, regulations and legislation relevant to the project. If such regulations do not exist, or are not applicable to the restoration project, the project should carry out a hazard analysis and develop policies based on project-specific hazards combined with existing legislation or guidelines, and include such policies in the personnel manual.

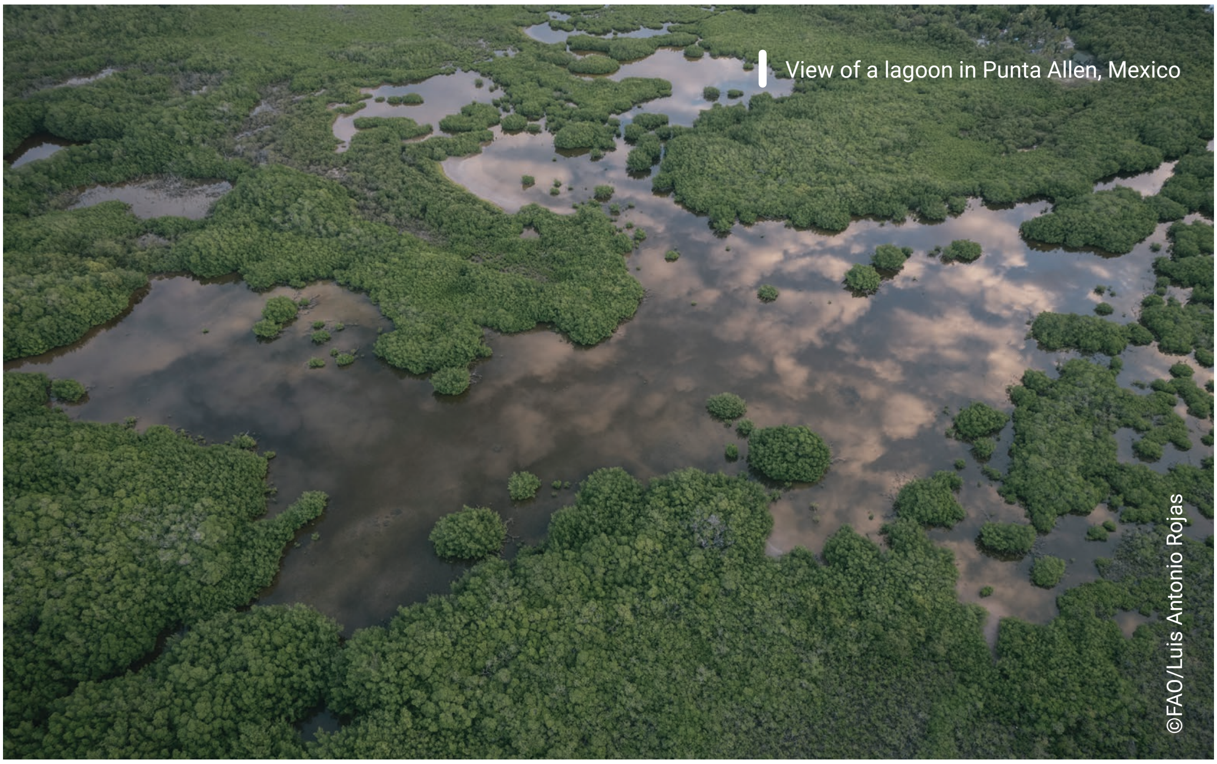
P7. Consider local, national and international legislation on Indigenous Peoples´ rights, including their right to FPIC. These rights must be respected and ensured in all the phases of the restoration project, particularly those at the community and local level, which tend to be oral and based on customary and collective rights and embedded in ancestral governance institutions that enforce them.

SC16 Risk assessment and management

Restoration projects may be susceptible to a variety of adverse events that can affect their outcomes. Early and continuing risk assessment and appropriate risk management may reduce these adverse effects. Risks can be broadly categorized as five types. First, there are environmental risks to the restoration sites that originate within or outside the project sites, including, for example, drought, wildfire, flooding, erosion and insect epidemics. Second, there are risks from technical issues with the implementation of restoration activities due to, for example, inexperienced personnel or changes in personnel, delayed or reduced funding, changes in regulatory requirements, or supply chain issues. The latter can result in ineffective implementation, lost labour and increases in overall costs. A third type of risk is from human conflicts that arise, for example, when restoration activities change the value of land or resources, which can result in disputes or vandalism. Additionally, withdrawal of FPIC could disenfranchise Indigenous Peoples and prevent cooperation, leading to violence and conflict. Fourth, outbreak of war or catastrophes outside the project area may create security concerns that prevent implementation or ongoing management. A fifth type of risk is from unintended negative consequences of the restoration activities, such as, increases in invasive species due to disturbances associated with project implementation.

All of these risks can affect the work schedule and project costs. Some risks can be determined from the site and context assessments, and baseline monitoring. Others, like adverse weather events, may be harder to predict, but contingency planning may ensure that work continues with schedule or activity modifications. Where there is a likelihood of human-conflict risks, the early establishment and communication of a transparent and accessible grievance redress mechanism is essential (SC9).

P1.	Undertake a full risk assessment to evaluate ecological, cultural, socioeconomic and legal risks associated with restoration activities. This includes assessing the potential collateral damages of restoration activities, including displacement of impacts of environmental degradation to areas outside the project site.
P2.	Analyse and compare risks and benefits of different restoration activities. Assess which interventions are feasible given the funds and personnel available and the local context.
P3.	Use an appropriate level of assessment to balance project risk with design and review expenses.
P4.	Identify a risk-management strategy for the project to deal with unexpected changes in environmental conditions, financing or human resourcing.
P5.	Develop a contingency plan that identifies threats to success, building on risk assessment, assumptions and constraints, and including adaptive-management strategies. The plan should include the worst-case scenario of having to abandon the project.
P6.	List elements (including regulatory approvals, permits and legal site access; and availability of resources such as funds, workers, materials, tools, supplies and machinery, seed testing certificates and native propagules) upon which the implementation of the restoration project is dependent. The consequences of any delays in obtaining approvals or materials should be considered.
P7.	The extent of risk assessment should be proportional to the level of identified risk. Where data are poor, risk assessment may only be qualitative, but it is still necessary because lack of data does not indicate absence of risk.



SC17 Information management and record-keeping

When planning restoration, application of best practices for information management and record-keeping is critical to allow for broad engagement, facilitate understanding and implementation of planned restoration and ongoing management activities, and enable adaptive management. Detailed records are needed for all planning and design activities, including notifications of opportunities for engagement by practitioners and other experts, and stakeholders and rights and knowledge holders. Furthermore, project records should include specific inputs and feedback received from individuals within these groups, as well as how this feedback was considered. In addition, major versions of the restoration plan should be maintained, along with the final and any updated versions. Along with the plan, information on project budgets (e.g. income and expenses) should be maintained. Maintaining all these types of information in an accessible way will allow everyone associated with the project to understand the project's trajectory and the decisions that were made and built into the final restoration plan. For this reason, restoration projects should develop a data and information management plan that includes guidelines for authorship and acknowledgement, management, archiving and sharing, and respecting data rights and sovereignty.

P1. Maintain records of:

- notifications of opportunities for engagement by practitioners and other experts, and stakeholders and rights and knowledge holders;
- assessment and scope of work documents used to develop the restoration plan, along with inputs and feedback received from practitioners and other experts, and stakeholders and rights and knowledge holders on these documents, and how comments were considered;
- major drafts of the restoration plan along with the final and any updated versions, and inputs and feedback received from practitioners and other experts, and stakeholders and rights and knowledge holders on these drafts, and how comments were considered;
- project budgets (e.g. income and expenses);
- contracts and work orders including costs, payments, and reports of completed work; and
- legal documents including permits and permissions.

P2. Maintain a decision log that documents key decisions on topics on which stakeholders and rights and knowledge holders disagree, decisions that change the direction of the project, restoration activities in which alternatives exist but only one or a few were selected, and decisions that could be challenged in court. Decision logs should capture the rationale and outcomes of key decisions for communication and adaptive-management purposes.

P3. Include in project records information on engagement of stakeholders and rights and knowledge holders, explanatory or educational materials, and community and press events.

P4. Ensure all information is backed up and archived in a format that is easy to share with others and will stand the changes in technological platforms. Consider archiving relevant information about the project to open-access repositories (when consistent with the data and information management plan, P5).

P5. Develop a data and information management plan to curate, maintain and archive data and information generated in all components (from assessment to monitoring and evaluation), and that establishes policies for authorship, ownership, rights and access of information. In particular, uphold and respect the FPIC of Indigenous Peoples and ensure their data sovereignty and respect their decisions on knowledge sharing.

SC18 Reporting and communication

Effective communication among stakeholders and rights and knowledge holders during planning and design of restoration can create a shared vision of the project's targets, goals and objectives, build trust, and avoid or reduce potential problems with project governance. Communication should not be top-down but rather should promote exchange among stakeholders and rights and knowledge holders to ensure that all types of knowledge are integrated in project design and that the interests and concerns of stakeholders and rights and knowledge holders are built into the project.

P1. Maintain accurate reports of project planning efforts so that information can be clearly communicated.

P2. Provide frequent communications to and hold regular meetings with project participants, including stakeholders and rights and knowledge holders, and external experts and practitioners to get feedback on and inputs into the restoration plan and design.

P3. Make sure that communications are sent in a timely manner to allow practitioners, experts, and stakeholders and rights and knowledge holders to participate in project activities.

P4. Communicate information accurately and in a manner that is accessible and tailored to the intended audience, with appropriate media and using appropriate languages.

P5. Recognize and publicize achievements and efforts of project participants, including practitioners, volunteers, partners, stakeholders and rights and knowledge holders, in developing the restoration plan, in accordance with any restrictions or considerations in the data and information management plan (SC17).

P6. Develop or strengthen public awareness of the values of ecosystem restoration, and the importance of integrating all types of knowledge and practices, including local, traditional, practitioner, scientific and Indigenous Peoples' knowledge, in developing restoration initiatives.

Plant nursery run by the Copaiba Environmental Association in Socorro, Brazil, which annually produces 450 000 seedings of 80 native species to support the Trinational Atlantic Forest Pact World Restoration Flagship

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IMPLEMENTATION

Care must be taken to perform restoration activities in a manner that maximizes net gain for nature and people. To this end, implementation should be done, as appropriate, in the context of participatory governance, social fairness and equity, by promoting fair and safe working conditions, and providing inclusive and equitable opportunities for engagement, co-management, decision-making, knowledge integration and the enhancement of livelihoods and well-being for restoration practitioners and other implementers, stakeholders and rights and knowledge holders, and key groups (SC19 and SC20). Likewise, educational and research institutions may be able to support restoration implementation projects by incorporating methods and tools into curricula. Furthermore, when implementing restoration activities, it is critical to ensure that sufficient human resources, tools and materials are available at project sites (SC21). All activities should be undertaken in compliance with applicable laws and regulations, and with respect for Indigenous Peoples' rights, traditions and customs, as well as rights and customs of key groups (SC22).

Ecosystem restoration involves innovation and experimentation, and restoration activities can result in unanticipated outcomes or setbacks. Therefore, it is recommended to conduct initial field trials or pilot tests to support decision-making (e.g. choice of species and spacing) or to install and test alternative activities to enable adaptive management (SC23). Likewise, several types of restoration activities or a sequence of actions may be needed to prevent or halt degradation, or amend abiotic and biotic conditions to reverse degradation and facilitate natural regeneration and establishment of translocated organisms (SC24, SC25 and SC26). For example, it is important to remove threats, such as non-native invasive species, that may adversely affect translocated organisms. Wherever feasible, practitioners and implementers should leverage opportunities for natural recovery (e.g. successional processes). However, where the potential for natural regeneration has been lost, additional measures may be necessary to re-establish organisms on the site. In many cases, to help prevent further degradation, it is critical to satisfy socioeconomic needs. This involves combining the use of restoration activities aimed at reducing societal impacts, improving ecosystem management and rehabilitating ecosystem services (e.g. sustainable management practices for soil, water and vegetation) with activities that generate livelihoods and food security for local communities (e.g. ecotourism, agroforestry). Importantly, when modifying biotic or abiotic conditions, measures should be adopted to avoid or minimize negative ecological, cultural and socioeconomic collateral damage, or to mitigate these impacts (SC27).

To maximize learning from restoration interventions, it is critical to document in detail the locations, types, intensities, frequencies and costs of all restoration activities (SC28). For example, if prescribed fire is used, it would be important to document the environmental conditions during the fire, which areas within the fire perimeter burned, and the intensity and severity of the fire where it occurred. This information is critical both for understanding and replicating best practices for implementing activities and monitoring outcomes. In addition, reporting and communicating about project implementation is important to raise awareness, mobilize and maintain support from the public, government, donors, and stakeholders and rights and knowledge holders, and to foster collaboration and mutual learning with other restoration practitioners and implementers (SC29).

BOX 4. INDIGENOUS PEOPLES' IMPORTANCE IN THE IMPLEMENTATION OF AN ECOSYSTEM RESTORATION PLAN

Indigenous Peoples are practitioners by nature and have undertaken ecosystem restoration and sustainable environmental management for centuries or millennia. Often their stewardship is part of their daily lives and culture and performed without external resources. Their practical knowledge and contributions to restoring and maintaining their ecosystems are based on long-term observations and tested practices. Therefore, Indigenous Peoples' knowledge about and practical experience with natural recovery processes, ecological connectivity, management of biodiversity and non-native invasive species, translocation of plants and animals, climate predictions and identification of threats and risks are needed to increase the likelihood that restoration implementation will be done in a manner that maximizes ecological, cultural and socioeconomic benefits.

When implementing ecosystem restoration, the proper management of Indigenous Peoples' data and knowledge is key. Indigenous Peoples around the world have undergone and continue to experience abuses with regard to research, commercial and other uses of their innovative and traditional knowledge and cultural expressions about biodiversity, sustainable practices in food systems, and environmental stewardship practices. There is an imminent and permanent risk of exploitation, appropriation or misrepresentation of Indigenous Peoples' knowledge. Therefore, all activities associated with information sharing (record-keeping, information management, reporting and communication), must acknowledge that Indigenous Peoples are the keepers and owners of their knowledge. The respect of Indigenous Peoples' knowledge (which recognizes both their innovative and traditional knowledge) must be linked with their data sovereignty. For this reason, free, prior and informed consent (FPIC) is fundamental when collecting and using Indigenous Peoples' knowledge during implementation.

When involving Indigenous Peoples in reporting and communicating the progress of implementation, it is critical to use strategies adapted to their languages and particular ways of communication. This will enable their meaningful participation in implementation. In addition, because the livelihoods of Indigenous Peoples often are directly affected by conditions in the project areas, their engagement in implementing restoration can increase potential for long-term positive results and sustainability of the restoration project.

IMPLEMENTATION

SC19 BROAD ENGAGEMENT

SC20 SUITABILITY, SAFETY AND WELL-BEING OF RESTORATION IMPLEMENTERS

SC21 MATERIALS, TOOLS AND SUPPLIES

SC22 COMPLIANCE WITH LAWS AND REGULATIONS

SC23 ADAPTIVE MANAGEMENT

SC24 IMPLEMENTING RESTORATION ACTIVITIES

SC25 ENHANCING NATURAL ECOSYSTEM RECOVERY PROCESSES

SC26 TRANSLOCATION OF PLANTS, ANIMALS AND OTHER ORGANISMS

SC27 MINIMIZING COLLATERAL DAMAGE FROM RESTORATION

SC28 INFORMATION MANAGEMENT AND RECORD-KEEPING

SC29 REPORTING AND COMMUNICATION

SC19 Broad engagement

Effective implementation and ongoing management require genuine and regular coordination and collaboration among the project implementation team and stakeholders and rights and knowledge holders. Transparency during implementation is always crucial, and particularly so when operating at the landscape or seascape scale, where there are likely to be more actors involved. To that end, stakeholders and rights and knowledge holders, including Indigenous Peoples and key groups, previously mapped during the assessment and planning and design components should be an integral part of restoration decision-making processes and restoration activities during implementation and ongoing management (e.g. during the selection of materials, supplies and tools; the revision or adjustment of the activities schedule due to seasonal, cyclic and unforeseen events; the selection of good practices for halting, preventing and reversing degradation, including practices associated with sustainable management, assisting natural recovery, modifying biotic and abiotic conditions, and minimizing collateral damage). Such active engagement is key to achieving restoration goals and objectives and sustaining restoration efforts in the long run. Likewise, it will facilitate communication about the project to new generations to ensure that the history of the project, and past investments and achievements, are understood and valued (SC29).

Members of the Sido Makmur community group in Betahwalang village, Demak district, taking white shrimp (*Litopenaeus vannamei*) from traps as a result of mangrove restoration initiatives of the Building with Nature World Restoration Flagship in Indonesia

©UNEP/Nathanial Brown

P1. Ensure that equitable and inclusive incentives and opportunities are provided to all stakeholders and rights and knowledge holders, including Indigenous Peoples and key groups, that were mapped and involved during the assessment and planning and design components, to meaningfully and actively:

- engage in decision-making processes and implementing restoration activities;
- contribute local, traditional, practitioner, scientific and Indigenous Peoples' knowledge and experience; and
- benefit from restoration efforts (e.g. through enhancement of livelihoods and food security).

P2. Invest in processes, capacity development and communication platforms to ensure enabling conditions for stakeholders and rights and knowledge holders to actively engage in, and benefit from, implementation, ongoing management and decision-making. Consider their languages, literacy levels, and power, cultural and social asymmetries.

P3. Address emerging disputes and grievances in case negative ecological, cultural or socioeconomic impacts of restoration activities arise, by following the grievance redress mechanism adopted in the planning and design component (SC9).

P4. Consult with experts, including practitioners and other implementers, as well as databases, knowledge platforms and restoration networks to identify, replicate and adapt effective practices from other projects about participatory tools and mechanisms that have effectively contributed to the meaningful involvement of stakeholders and rights and knowledge holders and key groups, in implementation and ongoing management.

P5. Respect FPIC throughout project implementation and ongoing management (including in data-collection processes and respecting Indigenous Peoples self-governance systems and structures, as well as their data sovereignty).

P6. Provide materials, equipment, and equitable incentives and remuneration to stakeholders and rights and knowledge holders, and specifically Indigenous Peoples as resource owners, for active engagement in the implementation of restoration activities.

P7. When implementing restoration activities, integrate the knowledge and good practices of Indigenous Peoples on natural recovery processes, ecological connectivity, management of biodiversity and non-native invasive species, translocation of plants and animals, climate predictions and identification of threats and risks.

P8. Include strategies to address the challenges of poverty, displacement and persecution of Indigenous Peoples that hamper their active engagement in implementation and ongoing management.[b]

SC20 Suitability, safety and well-being of restoration implementers

Engaging a suitable implementation team with appropriate capacities (skills, competencies and knowledge) and experience is key to the effective and efficient implementation of restoration activities. Likewise, clear definition of roles and responsibilities, according to required capabilities and experience, is critical to enable effective decision-making and increase cooperation. In many cases, it will be necessary to provide training to project implementers to develop and enhance the required competencies, skills and knowledge, and to ensure awareness of safety hazards (e.g. heavy machinery, remoteness, wild animals and steep slopes) and protocols. Moreover, all restoration projects must provide safe and fair conditions to ensure the health and well-being of implementers. These conditions should consider the traditions and customs of stakeholders and rights and knowledge holders, including Indigenous Peoples and key groups. Plans for health and safety should be elaborated to identify hazards and analyse the risks of restoration activities to the health of implementers, so that prevention and mitigation measures as well as protocols for contingencies can be established. Fair working conditions, including when applicable, adequate compensation for labour and proper contractual arrangements, help foster long-term engagement and ownership of the project by team members, which will contribute to effective implementation and achievement of restoration goals and objectives. In addition, maximizing and prioritizing sustainable livelihood or local employment opportunities (building on existing local capacities or enhancing them), as well as voluntary work, will be beneficial to incentivize community involvement.

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[b] Aspirational practices are denoted with colored shading behind the text throughout the *Standards of practice*.

P1. Establish the most suitable implementation team, including knowledgeable, qualified, skilled and experienced restoration practitioners, who are able to carry out restoration activities responsibly, effectively and efficiently.

P2. Define, document and clearly communicate roles and responsibilities of team members, including volunteers and others who are involved in the project.

P3. Ensure that project implementers, including paid staff and volunteers, are provided with on-the-job training to develop and enhance the skills, competencies and knowledge required to adequately carry out restoration activities, and to adopt health and safety measures, including the proper use of tools, chemicals, equipment and machinery.

P4. Ensure and oversee the implementation of safety measures and proper use of personal protective equipment (PPE), tools, chemicals, equipment and machinery, according to the sites' ecological context, the types of activities to be performed, legal and regulatory frameworks, and traditions and customs of Indigenous Peoples and key groups.

P5. Develop a health and safety plan in advance of implementation and ongoing management activities to:

- identify areas and activities that are hazardous to project implementers, visitors, and stakeholders and rights and knowledge holders;
- establish preventive and mitigation actions, without compromising the integrity of important ecosystem elements (e.g. ecosystem composition, structure and functions); and
- define protocols for contingencies, including emergency medical assistance, first aid, evacuation and communication.

The endemic firewood banksia (*Banksia menziesii*), one of several species being reestablished from collected seed and nursery stock in southwestern Australia and a staple food source for the critically endangered cockatoo (*Carnabys cockatoo*)

©Kerry Stokes AC

P6. When appropriate, create no-work zones in areas with important ecosystem elements to avoid compromising ecosystem integrity and the safety of implementers.

P7. Obtain safety insurance for implementers against accidents.

P8. Avoid health or safety risks to implementers and other people directly and indirectly involved in, or affected by, the project as a result of the use, storage, treatment and disposal of herbicides, pesticides and other toxic chemicals.

P9. When appropriate, promote physical and medical fitness of implementers, according to specific activities and locations (e.g. diving for coral restoration).

P10. Observe, respect and protect implementers' rights, and provide fair working conditions according to the existing legislation, labour policies and other guidance, including fair wages and contracts, as well as sanitation facilities, meal breaks, housing and transport (where needed).

P11. Prioritize and maximize livelihood, employment and capacity development opportunities for local communities and local restoration practitioners and contractors, building on existing local knowledge and striving for diversity, inclusivity and equity.

SC21 Materials, tools and supplies

Restoration projects use materials, tools and supplies for implementing restoration activities. To that end, the project management team should obtain and use materials, tools and supplies that are as effective and efficient as possible, within the available budget and preferably from the local market. The selected materials, tools and supplies should also be those that minimize collateral damage to the restoration sites. This involves making informed choices regarding the type, quantity and quality of materials and tools. Likewise, the availability of materials, tools and supplies, as well as options for transportation and other logistics should be considered in advance in order to avoid costly delays and to reduce project interruptions. This is especially true for projects that include translocation of plants and animals, which may need to be ordered well in advance of delivery.

P1. Establish specifications in terms of type, quantity, quality and genetic diversity of materials (SC26), including the living stocks (e.g. propagules, seeds, root stock, inoculum of mycorrhizae), tools and supplies (including machinery when appropriate) required for restoration activities to be performed. Check their availability (e.g. germplasm supply chain, phenological calendars), and when applicable, assess which approach is more efficient to obtain them (purchasing or renting), as well as the logistics needed to move them to and within the restoration sites. Allow adequate time to receive materials onsite.

P2. Select and procure the most sustainable, effective and efficient materials, tools and supplies according to the budget available, in consultation with suitably qualified people, including local restoration practitioners with experience of working conditions on the site or the specific ecosystem, and, where appropriate, with the local stakeholders and rights and knowledge holders directly involved in the project. When possible, obtain tools and supplies from the local market to reduce the carbon footprint and to support the local economy.

P3. Consider long-term safety, management requirements and sustainability of materials, tools, supplies and machinery before obtaining them.

P4. Ensure that all equipment is tested and certified properly and regularly as needed (e.g. dive equipment), keeping records as appropriate.

P5. Establish project sequencing (specific order of tasks), storage areas and site access.

P6. Ensure that project implementers, including volunteers, are provided with on-the-job training on the proper and safe storage and maintenance (when appropriate) of tools, chemicals, equipment and machinery to ensure their sustainability over time.

SC22 Compliance with laws and regulations

Restoration projects must be implemented in accordance with international and national laws and regulations, including those related to Indigenous Peoples' rights, traditions and customs, which is critical for long-term results in ecosystem restoration. Thus, the project management team should ensure compliance with all applicable laws and regulations identified during project planning. Part of ensuring compliance is, to the extent practicable, informing everyone involved in the implementation of a restoration project that they are expected to abide by relevant laws, regulations, traditions and customs that apply to the project and to their respective roles, and ensuring that they understand what is expected.

P1. Ensure compliance with approved project plans and permits (SC15) as required by laws and regulations.

P2. Consult and seek approval by the relevant regulatory agencies of any substantial modifications on the approved project plans.

P3. Ensure that the project complies with all relevant work, health and safety codes, and regulations and legislation (SC15 and SC20).

P4. Ensure compliance with national and international laws on the respect of Indigenous Peoples' rights and their right to self-determined development and FPIC.

P5. To the extent possible, support development of new legal tools and actions for the protection and recognition of Indigenous Peoples' rights, including their customary and collective rights.

P6. To the extent possible, identify issues within existing policy instruments that result in degradation of ecosystems, landscapes or seascapes or conflict among the rights of stakeholders and rights and knowledge holders, and promote changes and harmonization through participatory and consultative processes.

P7. To the extent possible, support the development of new policy instruments that can complement and strengthen the restoration activities by preventing, halting or reversing ecosystem degradation.

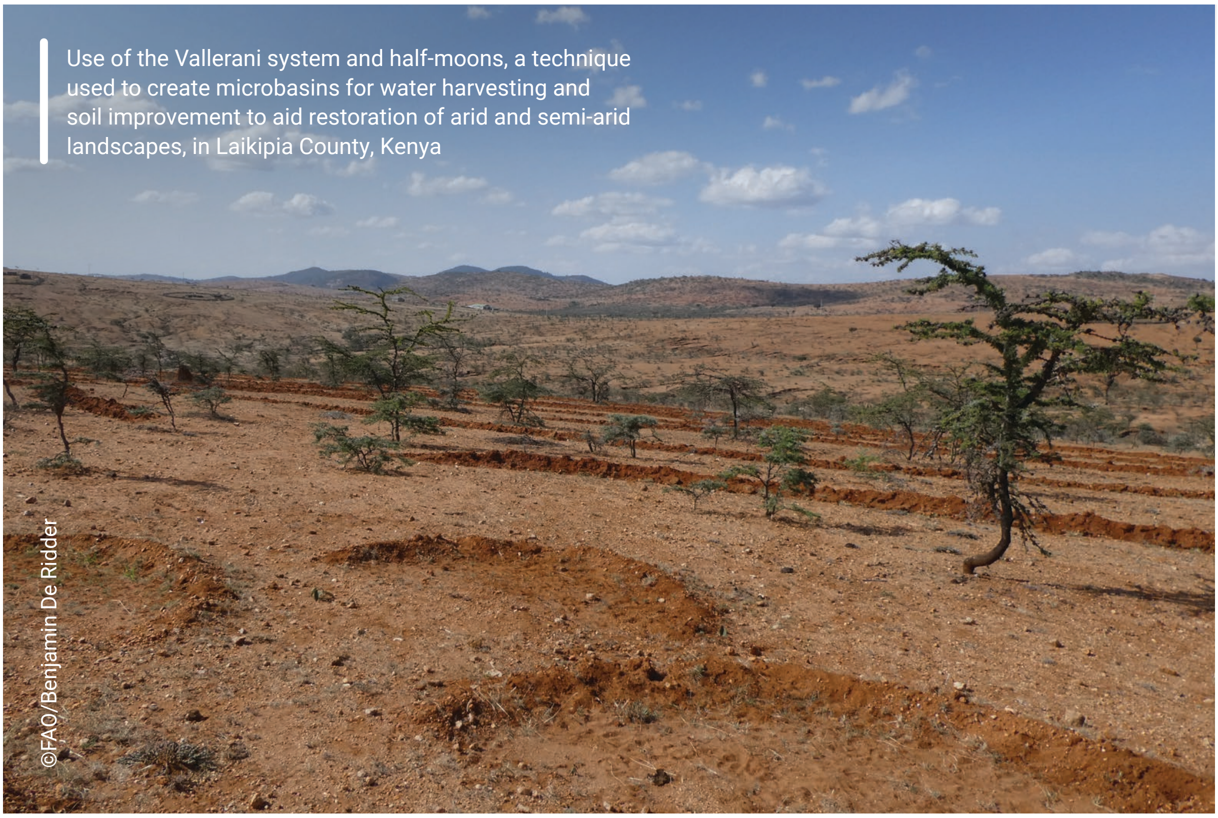
SC23 Adaptive management

Adaptive management often requires implementing alternative activities as well as a no-action alternative (i.e. leaving untreated areas of the site as controls). The details of each management activity should be described in the restoration plan (SC13). However, even with a well thought-out and articulated restoration plan, many decisions about project implementation will need to be made onsite during implementation. For this reason, project implementers should be alert to conducting activities in a way that maximizes the ability to learn from project outcomes. For instance, care should be taken to avoid bias in the locations where alternate restoration activities are implemented, as this bias could confound inference. For example, if all untreated controls are located in areas with lower abundance of weeds compared to the areas scheduled for restoration activities, the effect of treatment would be entirely confounded with pre-restoration weed invasion, and it would be challenging to understand the effectiveness of the restoration. Likewise, it is important to avoid timing restoration activities in a way that confounds seasonal or phenological differences with treatment effects. Implementing activities in more than one year can allow for broader inference about project results, as results may be driven by factors such as seasonal weather conditions that vary among years.

P1.	If feasible, all activities done on the sites to prepare the area for restoration should be standardized before carrying out planned restoration activities. When site-preparation activities vary, this variation should be included explicitly as part of the activity being tested.
P2.	Where uncertainty exists, test multiple alternative restoration activities and include a no-action alternative so that trends in areas that received activities can be compared against those left untreated.
P3.	Avoid bias in the location and timing of areas scheduled for each type of restoration activity to avoid confounding spatial and temporal variation with the effects of each activity.
P4.	Consider implementing pilot activities to test methods and outcomes before implementing activities across the project site, or implementing activities in an iterative manner to apply lessons learned over time during the implementation period.

SC24 Implementing restoration activities

Restorative management activities that prevent, halt and reverse degradation along the restorative continuum should be implemented according to the decisions made during planning and design. Depending on the level of degradation of the project sites, different approaches to restoration can be implemented: i) when degradation is low and the ecosystem can recover after removal of degradation drivers, relatively low-cost natural regeneration approaches can be utilized, including activities such as halting degradation (e.g. overfishing or deforestation, loss of soil fertility and health, water resource overextraction and pollution), removing physical (e.g. soil compaction) or biological (e.g. invasive species) barriers, and preserving conditions that will facilitate natural recovery (e.g. soil seed banks) (SC25); ii) when degradation goes beyond the threshold for ecosystem self-recovery following the removal of degradation drivers, or when recovery is too slow to occur within a critical time period, an assisted approach should be implemented, including activities such as mediating substrate conditions,



Use of the Vallerani system and half-moons, a technique used to create microbasins for water harvesting and soil improvement to aid restoration of arid and semi-arid landscapes, in Laikipia County, Kenya

©FAO/Benjamin De Ridder

building habitat features, and translocating suitable biological material (e.g. corals, propagules, seeds, seedlings, fungi) (SC26); iii) when degradation is very high or where ecosystems have been destroyed (e.g. through mining), more complex and costly activities may be undertaken to reconstruct major ecosystem components, including topography, substrates, species and functionality (e.g. riparian floodplains and riverside terraces, soil remediation, mine and quarry reclamation); iv) when degradation is in production ecosystems (e.g. agricultural lands), or when satisfying socioeconomic needs is critical to prevent further degradation, sustainable management activities that recover and improve productivity, and enhance livelihoods and food security of local communities, should be considered (e.g. intercropping, rotational systems, terracing, integrated multitrophic aquaculture or fishery enhancement, soil amendments, biostimulation of microorganisms). A mix of these approaches may be needed, especially at large sites or in multisite projects within which recovery potential and socioeconomic objectives may vary.

P1. Implement restoration activities in accordance with the restoration plan.

P2. Halt degradation and ensure that the site is protected from damage during and after restoration activities (e.g. fencing to prevent grazing animals invading the restoration site or creating firebreaks for wildfire control).

P3. Report to local authorities and collaborate with them to address and prevent degradation from illegal activities.

P4. Identify and build on traditional and Indigenous Peoples' management practices that effectively contribute to the restoration of the sites.

P5. Where necessary, remove or control undesirable species (e.g. invasive species, relict cultivated plants) that may prevent natural recovery, or negatively affect ecosystem integrity (SC25).

P6. Where applicable, establish or enhance protection measures for rare and endangered species that are present or have been translocated to the restoration sites.

P7. Establish protocols for responding to potential threats (e.g. fire, disease and pest outbreaks), and provide training and arrangement of facilities and equipment.

P8. Where necessary, modify the topography, chemistry (e.g. remove toxic chemicals), physical conditions of substrates (e.g. reduce soil compaction or add marine structures) or hydrology (e.g. removing barriers to re-establish water flow patterns), or create habitats (e.g. nest boxes, food and habitat species) to facilitate natural recovery and the establishment of translocated organisms.

P9. Where appropriate, facilitate the re-establishment of natural disturbance regimes (e.g. periodic fire, flooding). If necessary, implement surrogate activities (e.g. prescribed fire) when scale or location prevent natural re-establishment. Inform local stakeholders and rights and knowledge holders in advance to avoid conflicts and negative impacts.

P10. Implement sustainable soil management practices to recover soil structure and fertility, and to reduce and prevent soil erosion, compaction, contamination, acidification, salinization and alkalinization. Also implement sustainable management practices for water and vegetation, that together with soil management practices, can recover ecosystem services and productivity, and enhance job opportunities, income, food security and nutrition for local stakeholders and rights and knowledge holders, while contributing to ecosystem recovery.

SC25 Enhancing natural ecosystem recovery processes

Restorative activities that enhance natural regeneration processes should be prioritized when and where ecological conditions are suitable and socioeconomically appropriate. Natural colonization, establishment, growth and persistence of native plants and animals set recovery processes in motion, through biogeochemical interactions between plants and soils, and biotic interactions among plants, between plants and animals (e.g. pollination, herbivory and seed dispersal), and among plants, fungi and bacteria. These interactions affect the composition, structure and functioning of ecosystems, and consequently determine the provision of ecosystem goods and services. Natural recovery processes, therefore, can be an effective low-cost approach for site-based restoration, as well as the restoration of habitat corridors and buffer zones in fragmented landscapes. Although natural recovery – assisted or unassisted – may not be desirable or possible in some contexts, such as restoration projects in cities, production ecosystems, recreation areas or severely damaged environments, in other areas, it can be an effective restoration approach, especially over large spatial scales.

For ecosystems in the early stages of recovery, natural regeneration can be enhanced using assisted approaches, but these approaches should not include planting monocultures, especially of non-native species, that suppress or eliminate natural recovery. Ecosystem recovery processes take time, and interim restoration treatments may be required to ameliorate conditions to enable natural recovery. In some contexts, repeated treatments may be needed to recreate natural disturbance regimes essential for ecosystem recovery. Disruption of natural disturbance regimes should be considered when assessing barriers to natural recovery processes.

P1. Whenever possible, eliminate barriers to natural recovery processes, such as overgrazing, overharvesting, overhunting, overexploitation of aquifers, soil erosion, compaction from roads or trails, pollution, and fire when not consistent with the site's ecological fire regime. Management actions to remove these barriers should be tailored to the specific ecosystem and its disturbance regime, and the socioeconomic and landscape or seascape context.

P2. Whenever possible, control invasive plant and animal species that impede or misdirect natural recovery pathways using, to the maximum extent possible, mechanical (including hand removal) or proven biologically based methods of control rather than agrochemicals.

P3. Enhance the potential for establishment, growth and survival of desirable native species. Methods may vary between areas managed for production (farmlands or rangelands) and natural areas.

P4. If appropriate, consider reintroducing individuals of keystone native plant species or culturally significant species that fail to colonize and establish at a time and in a manner that will enable their recovery, or that are "nurse species" for others and hasten or enrich regeneration (SC26).

P5. Where appropriate, consider reintroducing native animal species (mammals, birds, reptiles, amphibians, fish and insects) that were previously eliminated from the area (SC26).

SC26 Translocation of plants, animals and other organisms

While some restoration projects can use natural recovery or assisted natural recovery without actively moving plants, animals and other organisms (e.g. fungi), many others involve their translocation to or within the restoration sites. Translocation activities can include, for example, planting or direct seeding of plants, shellfish reef seeding, reintroducing animals that are in decline or have been extirpated, and amending substrate organisms. There are three primary reasons to do translocations: i) augmentation or reinforcement of species already present at the restoration site; ii) reintroduction of species previously documented at the site or in the immediate vicinity of the site; and iii) introduction of appropriate native or non-native species not previously documented within the site. Non-native species should only be used if there is reliable information that they are non-invasive and when there is a specific role played by those species that cannot be fulfilled with a native species (e.g. to facilitate the growth of native key species in highly degraded or modified ecosystems). In the short term, translocations may reintroduce breeding populations, increase the total number of individuals at a site, or fill niches following removal of other species (e.g. invasive species). Translocations are not simple; rather, they involve complex decisions about logistics and methods to support survival, growth and reproduction of translocated organisms. Translocations also require significant investments of time and resources. In addition, poorly designed translocations can cause unintended collateral damage (SC27) (e.g. introduction of maladapted organisms and outbreeding depression, or introduction of non-native invasive species or diseases that may reduce viability of native populations and reduce ecosystem integrity).

P1. Follow restoration plans regarding timing, layout and procedures for the translocation of organisms.

P2. Only translocate species that are appropriate for the project objectives (e.g. restore natural or semi-natural ecosystems, restore biodiversity, improve food security) and project location, including current environmental conditions and projected environmental change (e.g. sea level rise, large hydrological modifications, climate change) that may influence viability in the project sites.

P3. Unless there are compelling reasons to do otherwise and native species cannot fulfil the intended purpose, use native and regionally or globally threatened species. Never introduce or augment non-native invasive or weedy species.

P4. Prioritize species that are essential for the re-establishment of ecological processes or that will make the restoration process more efficient or effective, such as species that provide desirable microenvironments, have multiple ecological or cultural roles, promote ecosystem recovery processes, or attract and provide resources for other desirable species (e.g. local fauna).

P5. Whenever possible, select species with cultural, spiritual or socioeconomic value to local stakeholders and rights and knowledge holders.

P6. Use genetically appropriate source populations based on best available local, traditional, practitioner, scientific and Indigenous Peoples' knowledge (based on their FPIC), to promote adequate levels of genetic diversity for both population viability and potential for adaptation to environmental change. Consider composite provenancing and trade-offs between locally adapted and climate-adjusted provenance of propagules, to improve restoration outcomes over time.

P7. To the maximum extent possible, avoid use of genetically modified organisms (GMOs), and follow local and national laws and guidance when their use is justified. If GMOs are proposed, seek and ensure FPIC from Indigenous Peoples when present in the restoration area, as in most cases, they do not welcome this approach.

P8. Document origin of source populations and locations of all translocated organisms.

P9. Follow established standards for the collection, storage and use of seeds and source material in restoration, or other relevant agricultural, horticultural, or marine guidance to ensure that high-quality seeds, propagules or organisms (e.g. cuttings, bulbs, seedlings, mature plants, live animals) are available as required by project plans, as well as the protection of sources of propagules, seeds and organisms from overcollecting.

P10. Ensure adequate supply of plants or animals to be used in translocations, which could include developing facilities for collecting and propagating seeds, conserving soil seed banks, contracting with or establishing nurseries or breeding facilities, and partnering with local institutions with live *ex situ* collections of rare or threatened species.

P11. When ordering plant materials or planning animal translocations, ensure that plans are in place early enough to have the organisms when needed (plans often must be made one or more years in advance).

P12. Follow best practices for preparing organisms for successful survival, growth and eventual reproduction at the sites, including treating seed-coats, using appropriate plant containers, growing out shellfish or coral colonies and hardening plants to field conditions.

P13. Translocate organisms at an appropriate life stage and schedule translocations of each species when the level of ecosystem recovery is appropriate. Adapt implementation schedules as needed to compensate for changes in weather, supply and other variables outside of project control.

P14. Provide appropriate aftercare to increase survivorship of translocated organisms, including activities such as weeding, mulching and fencing; providing supplemental fertilization or feeding, wind or shade barriers, or temporary irrigation; controlling pests or diseases; reinstating natural disturbance regimes at appropriate stages (e.g. regular fire, flooding) or critical biotic interactions (e.g. introducing urchins to restored coral plots to control detrimental algal growth).

P15. Use tools and approaches that facilitate monitoring of the effectiveness and effects of translocations, such as installing tags or barcodes on plants or animals and creating maps of areas where translocations occurred, and to the extent possible, involve local communities in monitoring the outcomes of the translocations (i.e. citizen science).

P16 Apply ethical practices related to translocation of animals. Document health conditions and genetic information of individuals to be translocated, and clearly identify habitat requirements (e.g. food, shelter provision and connectivity) and, if necessary, implement activities to establish suitable habitat in advance of translocations. If organisms have been raised in captivity, supplementary food may need to be provided after the release of individuals in the wild.

P17 Consider the appropriateness of translocation for species of cultural value for Indigenous Peoples and that hold spiritual connections for them to their sacred places. Some species are sacred and should not be used for restoration or are not to be handled by humans.

Planting crayweed (*Phyllospora comosa*) off the coast of Sydney, Australia as part of Operation Crayweed (an initiative of the University of New South Wales)

©Tom Burd

SC27 Minimizing collateral damage from restoration

Ecosystem restoration may require substantial alterations to the biotic (e.g. removal of invasive species) or abiotic (e.g. by adding soil amendments or changing river channels) conditions of the project sites. These alterations create disturbances that may result in short-, medium- or long-term collateral damage (i.e. negative effects) within the project or adjacent sites, or the larger landscape or seascape. For example, restoration practices could negatively affect other organisms on the restoration sites (e.g. herbicide use for weed control might impact native species regeneration) as well as other aspects of ecosystem and landscape integrity (e.g. fertilizer used at restoration sites may cause eutrophication of ponds and lakes downstream). Likewise, some restoration activities may cause negative cultural or socioeconomic effects (e.g. predation and crop raiding as a result of reintroducing animal species). Therefore, during implementation and ongoing management, measures should be adopted to avoid or minimize negative effects, or when unavoidable to mitigate their impacts. Collateral damage can be minimized by adopting practices that comply with environmental protection standards. Implementation and ongoing management should be done in a manner that facilitates monitoring of potential collateral damage, and lessons learned about collateral damage from monitoring and evaluation should be used to improve implementation and long-term management.

P1.	Recognize the need to avoid or mitigate negative ecological, cultural and socioeconomic impacts caused by restoration activities (e.g. contamination of water, compaction of soils, human–wildlife conflict, excessive production of waste materials, and insect vectors).
P2.	Follow the mitigation plan to address the potential ecological, cultural and socioeconomic collateral damage previously defined during the planning and design component.
P3.	Avoid overcollection of propagules (e.g. seeds, fruits) and overexploitation of natural resources (such as harvesting wood or diverting water) to build infrastructure or to support restoration activities.
P4.	Avoid the use of chemicals that negatively impact desirable species and abiotic elements (through direct application or drift, runoff or spills), including chemical-based pesticides, herbicides and fertilizers.
P5.	Take measures to minimize the carbon footprint of restoration activities.
P6.	Avoid adversely impacting desirable ecosystem services that the project site is already delivering (e.g. food, pollination and carbon storage).
P7.	Dispose properly of all types of waste used in the restoration and, in particular, non-biodegradable materials and chemicals (e.g. plastic bags used for seedlings; worn-out uniforms, gloves and safety equipment; and leftover pesticides, herbicides or other chemicals).
P8.	Clean equipment, vehicles and personal clothing to avoid spreading weeds, pests and diseases.

SC28 Information management and record-keeping

Although record-keeping is an essential part of implementing restoration activities, it is often overlooked or not done in sufficient detail. It is critical, for instance, to document the extent to which treatments were applied as specified in the restoration plan. Without that information, it may not be possible to interpret monitoring results or to allow further replication. For example, if project monitoring showed that a given activity only had an effect on a small portion of the project site, it would be critical to know whether the activity had been done on the entire site, in order to understand whether the effects were in fact variable, or whether the application was not consistent. Documentation on implementation (written and photographic) should always be done but is especially important for the many types of activities (e.g. herbicide application, prescribed burning) for which there may be high variability in application across a project site. Furthermore, documentation of implementation should include not just the type of activity and location, but also the level or intensity of the activity, how it was applied, and other aspects of the activity that might vary within and across sites. Environmental conditions during implementation should be recorded to facilitate assessing efficacy and effects, as well as for future planning. Unless it is recorded at the time of implementation, it may not be possible to collect this information later. Finally, detailed records should be kept on the costs of the restoration activities in terms of time and money, in order to adequately plan and budget future projects, and for scaling up restoration activities.

P1. Keep records of:

- suppliers of equipment, materials and tools used for implementation;
- the origin of organisms used on the project, including commercial sources or geographic coordinates and environment of wild source populations;
- the extent to which restoration activities were implemented as specified in the restoration plan (any deviations should be documented and justified);
- the specific types of activities implemented, including the materials used and intensity of treatment (for example, basal area removed, density of planted seedlings, flame lengths of prescribed fire or measures of fire severity, active ingredients and strength of application of herbicides);
- the area where the activities occurred, including both the geographic boundary and, within the boundary, areas where the activity was and was not implemented;
- the dates when the activities were implemented, along with relevant information about phenology of flora and fauna and weather (e.g. temperature, wind speed, precipitation) during the implementation period;
- all costs and in-kind resources utilized for implementation and ongoing management, including labour, supplies and tools, as well as any reallocation of funds;
- contracts and work orders including costs, payments and reports of completed work;
- any revenues generated through the sale of products and services that result from the restoration areas;
- the time spent on each task associated with implementation and ongoing management;
- stakeholders and rights and knowledge holders engaged in project implementation and ongoing management; and
- maintenance, testing and certification dates of equipment (SC21).

P2. Follow the restoration plan's data and information management plan (SC17) with respect to authorship and ownership of intellectual property rights; and management, archiving and sharing of data and information. In particular, ensure protection of rights and interests of Indigenous Peoples with regard to their knowledge and culturally sensitive information, respecting their data sovereignty. Implement FPIC when collecting and using Indigenous Peoples' knowledge.

SC29 Reporting and communication

Reporting and communicating about project implementation and ongoing management is critical to mobilize and maintain support from the public, government, donors, and stakeholders and rights and knowledge holders in order to maximize outcomes and benefits of the project. It will also raise awareness and provide inspiration to others about the need to undertake similar efforts in other locations. In addition, it will contribute to increasing the reliability of the project by demonstrating that activities are being implemented according to the restoration plan. Likewise, regular communication about outcomes and lessons learned when implementing restoration activities will enable knowledge sharing and mutual learning among stakeholders and rights and knowledge holders, restoration practitioners and scientists.

This will allow for the wider replication and adaptation of effective restoration practices and innovative approaches, avoiding the repetition of mistakes and contributing to the adaptive management of the project. To ensure inclusive access to knowledge and information, appropriate communication and dissemination channels should be developed, taking into account languages and literacy levels.

P1.	Ensure continuing communication about project implementation and ongoing management activities, including regular meetings and cultural activities with stakeholders and rights and knowledge holders to communicate about practices, innovative approaches, outcomes and lessons learned and to maintain the history of the project and celebrate its achievements, thereby motivating the initiation of similar projects elsewhere.
P2.	Engage stakeholders and rights and knowledge holders, including local restoration implementers, in reporting and communicating about project progress through publicly available media sources, considering languages and literacy levels.
P3.	Share information in face-to-face meetings including field visits to showcase ongoing activities.
P4.	Use communication techniques and channels that are regularly updated and culturally appropriate, adapted to the local languages and literacy levels, to facilitate access and understanding of relevant information as well as engagement of different stakeholders and rights and knowledge holders.
P5.	Recognize and publicize contributions and achievements of restoration practitioners, volunteers, partners, stakeholders and rights and knowledge holders and local communities in the actions undertaken to support the implementation and ongoing management of the project.
P6.	Identify and engage in practitioner networks and conferences from local, regional and international restoration groups to maximize opportunities for sharing and communicating knowledge and lessons learned.
P7.	Respect intellectual property rights and data-sharing agreements established during project planning.
P8.	As appropriate, upload project implementation information to ecosystem restoration information management systems within the project region or country or at the international scale.[c]
P9.	Strengthen public awareness on the importance of integrating in implementation and ongoing management all types of knowledge and practices, including local, traditional, practitioner, scientific and Indigenous Peoples' knowledge.

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[c] The UN Decade Framework for Ecosystem Restoration Monitoring (FERM) and other relevant platforms (e.g. the project database of the Society for Ecological Restoration's (SER) Restoration Resource Center).

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Ongoing vegetation management at Namami Gange World Restoration Flagship in India

NGDE
INDIAN
ARMY

ONGOING MANAGEMENT

Ongoing management (often referred to as “maintenance”) of restoration sites, after the primary project implementation has taken place, is an essential part of successful restoration. Restoration projects are unlikely to succeed in providing ecological, cultural and socioeconomic benefits if the sites are not revisited after the completion of initial restoration activities. Because of this, ongoing management should begin as soon as a phase of project implementation is completed to minimize potential of regression into a degraded state (through regular activities that address and control degradation drivers) and maximize progress towards medium- and long-term restoration goals and objectives. However, there may not be a clear point of transition from implementation to ongoing management, especially in long-term restoration projects, where implementation phases continue until agreed-upon levels of recovery are reached.

Continuous, active and inclusive engagement by all project participants is critical for ongoing management, following the practices recommended in the implementation component, to promote co-management, collaboration and capacity development for project sustainability. Information management, record-keeping, reporting and communication are also critical during ongoing management. Because the specific practices for these are the same as for implementation (SC19, SC28, and SC29), subcomponents and practices have not been repeated in this component.

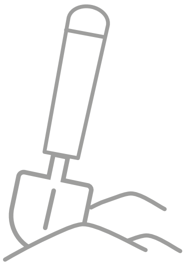
Realistic, cost-effective and sustainable plans for ongoing management (SC30) and adequate funding (direct or through revenues generated) (SC31) are essential, especially since personnel and budget resources are generally limited in this phase of the project. Planning and budgeting should consider that some long-term needs for ongoing management can be anticipated (e.g. site protection measures, continued removal of non-native invasive species, management of hydrological regimes and re-establishment of natural disturbance regimes), while needs may not be known in advance since ecosystems are dynamic and constantly changing, and unanticipated events can occur. Although they occur after implementation, ongoing management activities should be scheduled and budgeted during planning and design of restoration (SC13 and SC14) and in addition should allow for the development of anticipated and adaptive activities (SC32).

To foster continuous improvement, opportunities for the implementation of additional restoration activities at the project site or at the broader landscape or seascape scale should be explored based on reliable monitoring and adaptive management (SC33 and SC34). Application of lessons learned from monitoring and evaluation for adaptive management is essential over the long term to plan and implement any necessary corrective measures to avoid adverse impacts, and progress to long-term restoration goals.

BOX 5. INDIGENOUS PEOPLES' INVOLVEMENT IN ONGOING MANAGEMENT OF RESTORATION SITES

In contrast to the rest of the world's population, many Indigenous Peoples live in areas subjected or adjacent to restoration activities. Therefore, as inhabitants of restoration sites or the surrounding landscape and seascape, they are the actors best positioned to conduct ongoing management of the restoration sites. When allowed to maintain their territories and livelihoods, Indigenous Peoples through their management practices and food and knowledge systems and cosmogony and beliefs, developed in close relation with the environment, can effectively prevent and reverse ecosystem degradation, facilitate restoration project sustainability as well as sociopolitical resilience of the community.

Additionally, the lack of resources for Indigenous Peoples to maintain ecosystem restoration activities over time diminishes the impact and long-term benefits of restoration. Commonly, Indigenous Peoples lead ecosystem restoration processes without financial support, which jeopardizes the continuation of the work and could affect their food security, nutrition and environmental actions. Therefore, the development of long-term sustainable financing mechanisms for Indigenous Peoples' communities in restoration areas is a critical need. In addition, during ongoing management of restoration sites with Indigenous Peoples, implementers must consider the connection between project sites (both land and marine) and Indigenous Peoples' tenure rights (including their collective and customary rights), to ensure transparent recognition of their rights over the restoration sites and their ownership of their restoration plans, practices and knowledge.



ONGOING MANAGEMENT

SC30
ONGOING MANAGEMENT PLANNING

SC31
LONG-TERM RESOURCING

SC32
ONGOING MANAGEMENT ACTIVITIES

SC33
ADAPTIVE MANAGEMENT

SC34
CONTINUOUS IMPROVEMENT

SC30 Ongoing management planning

Requirements for ongoing management should be considered in the development of the restoration plan (SC13). After the primary elements of implementation are complete, the strategy and procedures for ongoing management should be revised and adjusted based on the results of monitoring and adaptive management. The ongoing management plan should be co-designed and co-implemented with local stakeholders and rights and knowledge holders, including local restoration practitioners and other implementers, who play a critical role in ensuring its effectiveness and sustainability over time. In addition, restoration planners might consider greater initial investment in restoration implementation or employing specific approaches to reduce the long-term management burden. Likewise, for those cases where the lead organizations need to conclude support in the short or mid-term, an exit strategy should be developed to transfer project management to local organizations to promote long-term sustainability. This implies empowering local organizations with the resources and capacities needed to continue with the restoration activities over the long term.

P1. Co-develop with stakeholders and rights and knowledge holders, including local restoration practitioners and implementers, an ongoing management plan that includes a detailed description of all planned activities, including their frequency and duration, and relevant management agreements. The plan should build as far as possible on effective practices, including traditional and Indigenous Peoples' management practices.

P2. Involve subject matter experts, including local restoration practitioners and other stakeholders and rights and knowledge holders, who can help develop innovative management methods based on lessons learned from other projects. Make the plan available to all those involved in the ongoing management of the project.

P3. Identify the ongoing management team and define, document and clearly communicate roles and responsibilities of members of the team before the project implementation ends to ensure a seamless transition.

P4. Ensure that Indigenous Peoples and key groups present in the restoration area are invited to be part of the ongoing management team and are adequately equipped with sufficient financial and material means so that they can play an active role in the ongoing management of the restoration project. If not fully secured during planning and design, ensure financial support for Indigenous Peoples and members of key groups to support and be part of ongoing management activities.

P5. Modify the ongoing management plan based on the results of periodic monitoring and evaluation, and changes in trade-offs or in the interests and needs of stakeholders and rights and knowledge holders.

P6. If needed, adjust the governance structure set forth in the restoration plan, considering different stakeholders and rights and knowledge holders, to oversee ongoing management and stewardship of the site, and ensure legal protections for the investments made in restoration.

P7. Design an exit plan if the implementing organization needs to conclude support in the short or mid-term, to transfer the project management to local organizations to foster long-term sustainability of restoration activities.

SC31 Long-term resourcing

Adequate funding and other resourcing for long-term ongoing management is essential. This can be through a combination of direct funding as well as through revenues generated (e.g. from ecosystem services). To the extent possible, ongoing management activities should be outlined, scheduled and budgeted during project planning and design (SC13 and SC14), and should be cost-effective and sustainable because long-term personnel and budget resources are generally limited. Some flexibility in allocating resources may be necessary to accommodate unforeseen activities.

P1.	If not fully secured during planning and design, determine appropriate long-term sources of funding for ongoing management. In addition to typical funding sources (e.g. governments, non-profits or the private sector), projects might consider crowdfunding and payments for ecosystem goods and services, when managed sustainably. Diversification of funding sources may allow long-term sustainability and reduce investment risk.
P2.	Coordinate with other restoration projects to reduce costs and duplication of effort. These synergies can include, for example, alignment of schedules to facilitate sourcing of plant materials, sharing of equipment and monitoring.

SC32 Ongoing management activities

The ongoing management team is responsible for the effective operationalization of the ongoing management plan to maximize outcomes, prevent deleterious impacts and avoid regression into a degraded state. Overall, ongoing management activities should facilitate recovery of essential ecosystem functions to maintain ecosystem integrity and enhance resilience to degradation.

P1.	Conduct periodic surveillance of the sites to check for recurrence of degradation to protect the investment in restoration, ideally involving local practitioners and other implementers, and stakeholders and rights and knowledge holders, including Indigenous Peoples and key groups living in and adjacent to the project sites.
P2.	Prepare contingency plans and protocols in case known degradation drivers re-emerge (e.g. populations of invasive animals that were previously managed through a biocontrol agent that ceases to function).
P3.	When needed, implement site protection measures to prevent deleterious impacts (e.g. protection from unsustainable grazing, prevention of inappropriate fire, prevention of unsustainable harvesting, control of infestations by invasive species, management of weeds and other vegetative competitors).
P4.	When needed, take measures to facilitate recovery of essential ecosystem functions and processes to maintain ecosystem integrity and enhance resilience to degradation (e.g. management of hydrological regimes, re-establishing natural disturbance regimes such as periodic fire in fire-adapted ecosystems or flooding in riparian zones).
P5.	Facilitate beneficial external exchanges with the broader landscape or seascape, including the exchange of genetic material in fragmented landscapes and seascapes (e.g. through hand pollination or movement of propagules) or areas with populations with inbreeding depression or other genetic deficiencies.
P6.	Develop or support training and stewardship programmes for local communities and restoration implementers, to improve ongoing management of the site and prevent harm from inappropriate management.

SC33 Adaptive management

Adaptive management relies on the results of regular monitoring for achieving and maintaining restoration success. This is especially important during ongoing management, when investment of resources may be limited, and memory of restoration history and successes may be diminished. For that reason, activities conducted as part of ongoing management should be planned based on lessons learned and should feed into the adaptive-management cycle. It is important to support activities that improve the ability to learn from project outcomes, for instance by maintaining the project's designated control areas and ensuring that needed hardware for future monitoring is available.

P1. Use the results of monitoring and evaluation to revise and adjust ongoing management activities previously planned.

P2. Invest in knowledge sharing, acquisition and training to incorporate updated best practices when designing and implementing responses to unexpected or unforeseen events that threaten the integrity of the restoration sites.

P3. Consult the restoration and monitoring and evaluation plans before conducting ongoing management, to avoid implementing activities in a manner that reduces the ability to learn about treatment outcomes.

P4. As feasible, conduct ongoing management activities in a manner that minimizes bias across sites and activities, to avoid confounding the effects of activities with differences among sites or other factors.

P5. Avoid implementing ongoing management activities in designated control sites (areas where restoration activities are not planned), in order to be able to assess the direct effects of restoration.

P6. Document assumptions and uncertainties associated with ongoing management and build explicit tests of these activities into restoration and monitoring and evaluation plans.

SC34 Continuous improvement

The levels and types of degradation at the project site, as well as time and resources available will determine the extent to which a project should include sequential phases or ongoing activities to meet long-term restoration goals. These sequential, or even overlapping phases, allow for continuous improvement, where managers continually upgrade and build on project goals to advance initial recovery towards progressively higher outcomes. To foster continuous improvement, opportunities for implementing restoration activities beyond those developed during project planning should be considered, based on findings from monitoring and evaluation. For example, the reintroduction of threatened species (e.g. cavity nesting birds or rare orchids) may have been outside the scope of restoration planning in the initial phases because of uncertainty in the availability of required habitat; however, if sufficient habitat has been recovered, the reintroduction could be accommodated during subsequent restoration projects or later in a multiphased restoration programme.

P1. Seek opportunities for the implementation of additional restoration activities or projects at the project sites or in the broader landscape or seascape through replication or scaling-up.

P2. Conduct additional restoration activities that take advantage of the improved conditions at the site (e.g. infill planting, reintroduction or augmentation of rare species, reinstatement of natural disturbance regimes).

P3. Explore further funding mechanisms and capital investment to extend restoration to adjacent or nearby sites, including the development of partnerships with local agencies and other organizations.

P4. Promote engagement and buy-in from local stakeholders and rights and knowledge holders, including Indigenous Peoples and key groups, so that they can foster and be part of continuous improvement.

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Field monitoring on the Kazakhstan plains for the Altyn Dala World Restoration Flagship

MONITORING AND EVALUATION

Ecosystem restoration is a long-term process with uncertainties about how to best achieve restoration goals. Furthermore, climate change adds even more unknowns about ecosystem responses to restoration activities. Consequently, it is imperative to monitor and evaluate restoration projects over time to determine the extent to which restoration activities were implemented as planned (implementation monitoring), as well as to assess restoration outcomes – the degree to which restoration goals and objectives were achieved (effectiveness monitoring) and the ecological, cultural and socioeconomic effects that resulted, whether positive or negative (effects monitoring). When done correctly, monitoring and evaluation enables ongoing management to be adaptive, so that successful actions can be adopted and expanded, ineffective approaches can be discontinued, and promising new methods can be added.

The best outcomes from monitoring will be achieved using a participatory approach (SC35) that engages stakeholders and rights and knowledge holders, including Indigenous Peoples and key groups, and incorporates multiple methods and types of knowledge, including local, traditional, practitioner, scientific and Indigenous Peoples' knowledge. Including people with diverse skill sets and knowledge bases will facilitate the identification of monitoring aims, objectives and key questions to be addressed, based on stakeholders' and rights and knowledge holders' interests and concerns. Experts in assessing biophysical, cultural and socioeconomic indicators are needed to develop monitoring methods that are powerful enough to detect trends and answer key questions.

For monitoring to reliably answer questions about restoration implementation and outcomes (effectiveness and effects), the monitoring and evaluation plan (SC36) requires more than just protocols for making observations about the restoration project. Rather, it requires specific monitoring aims and objectives (SC37) related to the restoration targets and activities, as well as questions that will be addressed, and monitoring and sampling designs tailored to the selected indicators for answering those questions (SC38 and SC39). It also requires protocols for collecting data (SC40) in a way that can be repeated over time and for analysing data and interpreting results (SC41). An important, but often overlooked, aspect of monitoring is periodic evaluation of whether the monitoring and evaluation effort is efficiently achieving its aims and objectives and, when necessary, adapting to improve the effectiveness and reliability of the monitoring effort (SC42). Procedures and timelines for implementing all aspects of monitoring from data collection to evaluating the efficacy of monitoring should be included in the monitoring and evaluation plan. The plan should also include procedures and timelines for information management and record-keeping (SC43) and sharing findings (SC44), so that lessons learned can be utilized for adaptive management (SC12, SC23, SC33 and SC45).

Although monitoring and evaluation is presented as the last component of the *Standards of practice*, development of the monitoring and evaluation plan should be done before or together with practices in the assessment and planning and design components of the restoration project, and well before implementation of restoration activities. This is critical for obtaining required resources and scheduling monitoring activities directly into the restoration project plan. Equally as important, it allows monitoring questions to be directly linked with the ecological, cultural and socioeconomic goals and objectives of restoration. Furthermore, for many monitoring questions, it is essential to collect baseline (or pre-treatment) data, which is only possible if monitoring activities are designed prior to restoration implementation.

Besides evaluation of implementation and outcomes (effectiveness and effects) of restoration activities, there are other equally important aims of monitoring (SC37), including evaluation of project governance, benefit sharing and leadership, information sharing, project support and trust among stakeholders and rights and knowledge holders, and quality of technical trainings on ecological, cultural and socioeconomic assessment. Unless the full set of monitoring aims are well articulated in the monitoring and evaluation plan, with specific objectives and methods, the project will not be well positioned to achieve them.

The scope and intensity of monitoring and evaluation will necessarily vary with project resources and the degree of uncertainty and risk associated with restoration activities. However, even with limited resources, monitoring and evaluation can be integrated into restoration projects by strategic selection of monitoring aims, objectives, questions and indicators, as well as approaches – from those that are less expensive (e.g. photo points, qualitative metrics, quantitative field surveys) to more expensive techniques (e.g. eDNA, drones, satellite imagery). The recommended practices included in all subcomponents of the monitoring and evaluation component are designed to be useful for maximizing learning from restoration activities and minimizing the wasting of resources on monitoring efforts unlikely to yield results. It is the task of the project management team to ensure that the monitoring and sampling design remains within the scope of the project, is sufficiently rigorous to allow inference, and is designed within an adaptive-management framework.

BOX 6. IMPORTANCE OF INVOLVING INDIGENOUS PEOPLES IN MONITORING PROCESSES

Indigenous Peoples are game-changers for understanding the efficacy and effects of restorative activities because of their permanent interrelationships and connections with nature. The knowledge that arises from these interrelationships and connections can improve efforts to monitor and evaluate restoration outcomes. Additionally, for projects located where Indigenous Peoples live, they can generate evidence in real time about the improvement of an ecosystem (including elements such as connectivity, integrity and regeneration). Furthermore, engaging in meaningful, inclusive and culturally appropriate collaboration with Indigenous Peoples during project monitoring and evaluation will improve the utility of monitoring and evaluation efforts, and also ensure that they have the necessary information and time to make informed decisions about the restoration project. To allow the practical engagement of Indigenous Peoples in monitoring and evaluation, it is critical to fully and effectively implement free, prior and informed consent (FPIC), including by providing appropriate channels for feedback, comments and grievances, considering their local and traditional languages and ways of communication.

Monitoring and evaluation should assess the outcomes of restoration activities developed through Indigenous Peoples' practices and their adaptive management, as well as other approaches. Regardless of the activities being assessed, there are key considerations for Indigenous Peoples in the selection of monitoring indicators. Indicators must reflect not only the advancing of the restoration process but the reinforcement of Indigenous Peoples' rights, improvements in their livelihoods (including their food and knowledge systems), their contributions to the restoration of the ecosystem, and the project's integration of Indigenous Peoples' knowledge, and cultural and spiritual values, and adherence to FPIC and Indigenous Peoples' rights and data sovereignty. In addition, Indigenous Peoples sometimes have specific ways of assessing the environment, including using specific indicator species; these should be considered during the selection of monitoring indicators. Indicators from Indigenous Peoples should be compiled through a participatory process following FPIC and respecting their languages.

For all monitoring and evaluation activities, it is critical to respect Indigenous Peoples as holders and owners of their knowledge, with the right to decide the terms of collection, storage, sharing and divulging of this knowledge. Indigenous Peoples are the rightful and perpetual custodians of their traditional and innovative practices, cultural heritage and contributions. Their knowledge and value systems are deeply intertwined with their identity, spirituality and connection with nature. Indigenous Peoples have the inherent right to determine how, when and to what extent other entities share or use their knowledge. This includes the right to control access, set conditions and establish terms for the dissemination of their knowledge. In line with this principle, all activities related to monitoring data and information, including collection, management, reporting and knowledge sharing, must uphold the principles of FPIC. Free, prior and informed consent is not merely a procedural requirement but a fundamental ethical obligation to acknowledge and respect Indigenous Peoples' autonomy and decision-making authority over their knowledge and resources. This is a very sensitive matter for Indigenous Peoples, based on past experiences of data piracy, and if not treated with care can derail otherwise good proposals and projects.

MONITORING AND EVALUATION

SC35 BROAD ENGAGEMENT

SC36 MONITORING AND EVALUATION PLAN

SC37 MONITORING AIMS AND OBJECTIVES

SC38 SELECTION OF INDICATORS

SC39 MONITORING AND SAMPLING DESIGNS

SC40 DATA COLLECTION

SC41 DATA MANAGEMENT, ANALYSIS AND EVALUATION

SC42 EVALUATION OF THE EFFECTIVENESS OF THE MONITORING EFFORT

SC43 INFORMATION MANAGEMENT AND RECORD-KEEPING

SC44 REPORTING AND COMMUNICATION

SC45 ADAPTIVE MANAGEMENT

SC35 Broad engagement

Regardless of who initiates the restoration project, the engagement of stakeholders and rights and knowledge holders in monitoring, evaluation and adaptive management is fundamental to develop adequate monitoring aims and objectives, determine priority questions to address through monitoring, and ensure that the indicators are ecologically, culturally, socioeconomically and ethically acceptable. Participatory monitoring, which enables local stakeholders and rights and knowledge holders, including Indigenous Peoples and key groups, to be actively engaged in decision-making processes about what, how, why and when to measure, not only increases the probability that the monitoring effort responds to local concerns, but also provides unique opportunities to engage in and learn through hands-on experience in data collection, analysis and evaluation, fostering capacity development and environmental stewardship. In addition, this engagement is important to maintain dialogue and interest between local, subnational and national institutions, co-produce and exchange knowledge (or lessons learned), facilitate early detection of emerging problems, and enable everyone to adapt to necessary agreed-upon changes. Iterative evaluation and learning processes (e.g. through multistakeholder dialogues) reaffirm or challenge the collective vision developed at the project start. Engaging stakeholders and rights and knowledge holders in evaluation processes, facilitating adaptive learning and empowering the voices of Indigenous Peoples and key groups in the assessment process can validate their knowledge, shift power into their hands, and lead to locally demanded, actionable change. For Indigenous Peoples to be involved in the monitoring and evaluation component, it is essential to ensure that FPIC is fully and effectively obtained and implemented, and includes appropriate channels for feedback, comments and grievances.

P1. Ensure enabling conditions and provide capacity-development opportunities to empower stakeholders and rights and knowledge holders to participate in all phases of monitoring, evaluation and adaptive management (e.g. identifying aims and objectives of monitoring, developing the monitoring and evaluation plan, and engaging directly in data collection, evaluation and reporting).

P2. Develop citizen-science opportunities for stakeholders and rights and knowledge holders to participate in monitoring and evaluation, in order to exchange knowledge, provide training in environmental assessment, increase capacity for monitoring, and foster long-term interest in the restoration project.

P3. Monitor, maintain and reaffirm FPIC with Indigenous Peoples as rights and knowledge holders in monitoring and evaluating the restoration project. In case there are doubts or concerns, review the monitoring and evaluation plan, discuss possible adjustments with Indigenous Peoples and review as necessary their consent or withholding of their consent, in accordance with FPIC. Indigenous Peoples' data sovereignty must be fully respected.

Little Citizen Scientist Study Programme observing the South China torrent frog (*Amolops richetti*) in Qianjiangyuan National Park, as part of the Shan-Shui Initiative World Restoration Flagship in China

©World Wildlife Fund

P4. Implement consultation processes to identify impacts (positive or negative) of the restoration project on the rights of related stakeholders and rights and knowledge holders, including Indigenous Peoples and key groups.

P5. Integrate local, traditional, practitioner, scientific and Indigenous Peoples' knowledge about the restoration sites when evaluating the effects of the restoration activities.

P6. Provide stakeholders and rights and knowledge holders with equal and regular access to transparent information on project performance to allow for validation of project results and to revisit or modify restoration goals based on lessons learned as part of transparent decision-making processes. Create opportunities to ask questions, raise concerns, share knowledge, develop common understandings and work cooperatively.

P7. Use effective communication strategies to interpret complex data and make it usable for decision-making. Consider languages and literacy levels, as well as power, cultural and social asymmetries, especially when engaging with Indigenous Peoples and key groups.

P8. Provide opportunities for stakeholders and rights and knowledge holders to be engaged in utilizing results of monitoring and evaluation for adaptive management, decision-making, and internal and external communication.

SC36 Monitoring and evaluation plan

Best practice is to develop a monitoring and evaluation plan in tandem with the development of the assessment and planning and design components of restoration. The monitoring and evaluation plan should include well-articulated aims of monitoring and, for each aim, key objectives and questions to be addressed through monitoring, as well as the specific indicators and approaches that will be used (i.e. monitoring and sampling designs for testing the implementation, effectiveness and effects of restoration activities). It should also include detailed instructions for all required activities for effective monitoring, including collecting and managing information; analysing information and using it to tell a story about restoration progress; sharing lessons learned with stakeholders and rights and knowledge holders; applying lessons learned within and across programmes; and assessing the efficacy of the monitoring itself. Including detailed instructions for each of these activities in a monitoring and evaluation plan during the assessment and the planning and design components of restoration will greatly increase the likelihood that the aims and objectives of monitoring will be achieved. For instance, if the monitoring questions and methods for testing outcomes are not detailed before conducting baseline monitoring, it may not be possible to measure the effects of restoration activities. In addition, unless all aspects of monitoring have been planned prior to developing restoration project budgets, funding for monitoring may not be available. Furthermore, having a detailed monitoring and evaluation plan safeguards the monitoring and evaluation process when project staff changes. If data are not appropriately archived with explanatory information, it may be impossible to access data collected in previous years to assess trends observed in future ones.

Include in the monitoring and evaluation plan:

P1. Specific aims and objectives of the monitoring effort.

P2. Specific questions to be addressed about the implementation and effectiveness of the restoration activities, as well as their effects (intended and unintended, positive and negative), at the site and landscape or seascape scale.

P3. Detailed descriptions of each indicator that will be collected, as well as the specific design for sampling each one, and required level of replication.

P4.	The specific monitoring design that will be used to answer each monitoring question, including the number of replicates of each type of site to be sampled (areas where restoration activities are planned, areas to be left as untreated controls, and areas to be sampled for the reference model) and their locations, as well as the number of replicate subsamples within each site, and the frequency and timing of data collection (pre-treatment, implementation and post-treatment).
P5.	Protocols and forms for data collection that are detailed enough to be consistently applied by different people over time.
P6.	A data management plan that establishes the procedures for processing, curating, archiving and safekeeping monitoring data, and the people or entities that will have access to the data, consistent with the project's data and information management plan.
P7.	Methods for using the data to achieve each monitoring aim and its objectives (e.g. methods for analysing data to determine the efficacy and effects of restoration activities).
P8.	Procedures and timelines for stakeholder and rights and knowledge holder engagement, information management and reporting, communication and adaptive management.
P9.	Procedures for assessing the reliability and efficacy of the monitoring effort, including the frequency in which it will be reviewed.
P10.	Details about the individuals or organizations that will be responsible for each task that is part of the monitoring and evaluation.
P11.	Details about the training that will be provided to individuals working on monitoring.
P12.	Estimates of the costs of monitoring and how monitoring resources will be allocated within the project budget.

SC37 Monitoring aims and objectives

Restoration monitoring can have multiple aims. For example, one primary aim is learning about the implementation and outcomes (ecological, cultural and socioeconomic) of restoration activities. However, other equally important aims include assessing project governance, the extent to which information was shared, and satisfaction and support for the project, among others. Unless all aims of monitoring are well articulated and included in project planning, the project will not be well positioned to achieve them. Best practice is to use participatory approaches to develop monitoring aims and objectives, to facilitate including all types of knowledge, including local, traditional, practitioner, scientific and Indigenous Peoples' knowledge, and to ensure that aims and objectives match stakeholder needs, concerns and interests.

Objectives related to monitoring the outcomes of restoration activities will vary by project based on the type of ecosystem, the intensity and degree of uncertainty and risk, and the concerns and interests of stakeholders and rights and knowledge holders. That being said, monitoring should address ecological, cultural and socioeconomic trends. Specific monitoring objectives and questions should be developed to address the extent to which threats have been removed and the effectiveness and effects of restoration activities at the site and landscape or seascape scale. All objectives should be achievable with project resources, and directly relevant to the key learning needs for the project's ecosystems and activities, or resources will likely be wasted on monitoring activities that do not generate useful information. In addition, objectives and questions should be time-specific (short, medium and long time frames) to facilitate generating information that will be used for assessing progress and taking corrective action,

A green sea turtle (*Chelonia mydas*) - the last remaining of the three sea turtle species that formerly inhabited this area - leaving a nest on Moheli Island in the Comoros within the Small Island Developing State World Restoration Flagship

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as needed, and for scaling and replicating the restoration activities. In addition, given that contributing to the United Nations Sustainable Development Goals and goals of the Rio Conventions is a guiding principle of ecosystem restoration for the UN Decade, when possible, monitoring should aim to provide the information needed to integrate the restoration project into current goals of United Nations and other allied global initiatives.

In addition to assessing outcomes of restoration activities, the monitoring programme also should have specific aims related to project governance, sharing lessons learned and contributing to adaptive management, and building trust and promoting equitable distribution of benefits and responsibilities among stakeholders and rights and knowledge holders. These aims, as well as specific objectives and methods, should be explicitly included in the monitoring and evaluation plan.

P1. Ensure that the aims and objectives of monitoring reflect the intensity and degree of risk associated with the restoration activities at both the site and wider landscape or seascape level.

P2. Develop monitoring aims, objectives and questions related to assessing the implementation and outcomes from restoration activities, including:

- the extent to which activities were implemented as planned;
- the degree to which ecological, cultural and socioeconomic threats have been removed and the potential for new threats;
- the extent to which the restoration project's ecological, cultural and socioeconomic goals and objectives have been achieved over short, medium and long time frames;
- the effects of the restoration activities (both intended and unintended, positive and negative), over time on ecological, cultural and socioeconomic conditions at both the site and landscape or seascape scale;
- the extent to which the restoration activities contribute to local, national and international restoration goals; and
- "trigger points" or "thresholds" in ecological, cultural and socioeconomic conditions that signal that corrective actions may be needed (e.g. crossing a tree canopy-cover threshold may represent a trigger point related to canopy structure and fire regimes).

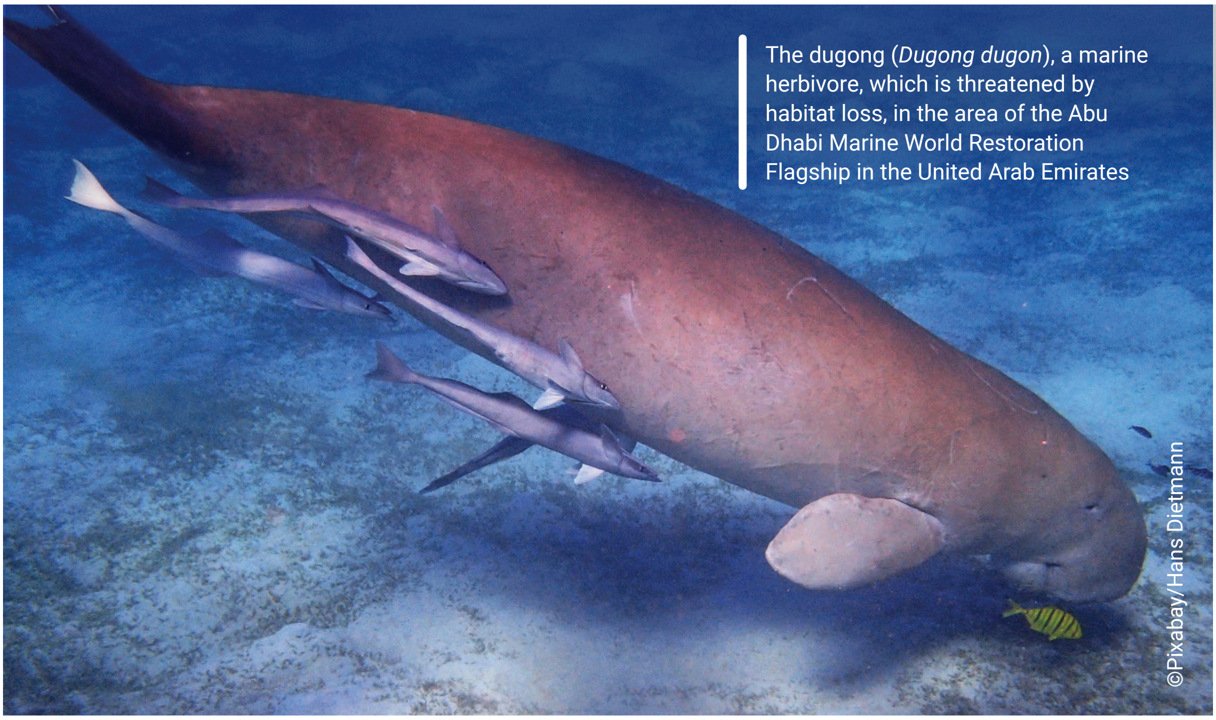
P3. Develop monitoring aims, objectives and questions related to assessing:
- the extent to which lessons learned from monitoring were shared and utilized for adaptive management;
- the effectiveness of project governance;
- equitability in benefit sharing;
- the extent to which the project is meeting stakeholders' and rights and knowledge holders' expectations and providing learning opportunities;
- improvements in practitioner technical knowledge about and capacity for implementing restoration activities; and
- project costs and the cost-effectiveness of restoration activities.

SC38 Selection of indicators

Selecting appropriate ecological, socioeconomic and cultural indicators to monitor is essential for tracking the progress of a restoration project over time against its goals. Any variable selected as an indicator should be relevant to monitoring aims, objectives and questions, and should be specific and measurable. For example, although increasing native plant abundance and improving livelihoods are common objectives of restoration, they are not suitable indicators as they are not in and of themselves measurable. Relevant indicators for these factors could be foliar cover of native plants (percent cover) and household income (in local currency), respectively. Monitoring some factors or aspects of restoration may require measuring multiple indicators. For instance, assessing the degree of inclusivity in project decision-making may require measuring indicators of transparency, participation, equity and accountability scored using well-designed surveys. A project's monitoring indicators, whether ecological, cultural or socioeconomic, should capture both positive and negative impacts of restoration and should be developed together with project stakeholders and rights and knowledge holders, including Indigenous Peoples and key groups.

Indicators will vary among projects, depending on the type of restoration activities, the type of ecosystems, the temporal and spatial scale of the project, the landscape or seascape context, and identified threats, risks and uncertainties. Indicators should be selected based on best available local, traditional, practitioner, scientific and Indigenous Peoples' knowledge, and in accordance with local and landscape conditions. Practical considerations also may influence the indicators that are chosen, for example if the project is part of a broader restoration programme for which indicators have already been set, or if a government agency has stipulated specific indicators as performance standards. Despite these constraints, where possible, indicators should be harmonized with other restoration monitoring efforts – even at the global level – so that results can be synthesized to maximize learning. This harmonization is necessary, as often the power to detect trends in effectiveness and effects of restoration activities requires data from more than one project.

Indicators should be set prior to project implementation so that baseline monitoring data can be obtained. When assessing restoration outcomes, the same indicators should be measured before and after implementation of activities in project sites and in control areas (areas that do not receive restoration and that have a similar degree of degradation to the project sites) to assess the direct effects of restoration activities, and within project sites post-restoration and reference sites (areas that are similar to the condition that the project site would have been in if degradation had not occurred) to assess degree of recovery. Although ideally the initial indicators should remain constant throughout the project to allow change over time to be assessed in a consistent manner, indicators may need to be



The dugong (*Dugong dugon*), a marine herbivore, which is threatened by habitat loss, in the area of the Abu Dhabi Marine World Restoration Flagship in the United Arab Emirates

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removed if not useful or reliable. In addition, there may be a need to add new indicators that could not be measured during earlier stages of restoration or that need to be sampled in response to changes in the monitoring aims, objectives and questions, based on the evolving needs of stakeholders and rights and knowledge holders.

A key consideration when selecting indicators should be the capacity of the project team, including the involved stakeholders and rights and knowledge holders, to measure the selected indicators with the required level of precision, given available resources. If the team does not have the appropriate capacity, it does not necessarily mean that the indicators should be excluded, but rather that additional expertise or training may be required.

P1. Determine indicators during the project assessment and planning and design components of the restoration process, so that resources required for monitoring can be built into project budgets, and the baseline monitoring can serve as the benchmark for assessing trends over time.

P2. Select indicators that are appropriate for the monitoring aims and objectives and that can be used to answer specific monitoring questions about biodiversity, ecosystem integrity and human well-being at the appropriate spatial scale (site versus landscape) and temporal scale (fast-responding variables versus those that are slower to respond). Limit indicators to those that are directly useful for these purposes, because data collection is resource intensive.

P3. For implementation monitoring, select indicators of (see the implementation component):

- the extent to which restoration activities were performed in accordance with the restoration plan, including the area treated and the intensity of treatment;
- the environmental conditions during the time of implementation;
- the degree of disturbance associated with implementation of restoration activities;
- compliance with laws and regulations; and
- the contract performance rate (whether the implementation is carried out in accordance with the contract and budget).

P4. For effectiveness and effects monitoring, select indicators of:
- biophysical conditions that span the physical environment, species composition, ecosystem structure and function, external exchanges (e.g. landscape connectivity) and threats (when possible, select indicators of genetic composition and diversity; when restoration treatments include the translocation of species, select indicators of rates of survival, reproduction and vigour of planted species or translocated animals);
- cultural attributes, including sociocultural identity, and spiritual, cosmogonic and cultural values and rights; and
- socioeconomic conditions that span community well-being (e.g. income, health and equity); stakeholder and rights and knowledge holder engagement, trust and satisfaction; benefits distribution; and the value of ecosystem goods and services, and other direct and indirect short- and long-term economic benefits.

P5. For assessing aspects of the restoration project as a whole, such as project governance and diversity, equity and inclusion, consider indicators related to integrating all types of knowledge into the restoration process, as well as stakeholders' and rights and knowledge holders' contributions.

P6. When selecting cultural and socioeconomic indicators, ensure disaggregation by gender, ethnic group, age and other factors, to better scope the needs and expectations of different groups, especially those that are vulnerable.

P7. Select indicators based on best available local, traditional, practitioner, scientific and Indigenous Peoples' knowledge, and with consideration of stakeholders' and rights and knowledge holders' views.

P8. For the range of indicators that could be measured, consider the difficulty and cost of measurement, and select those for which there is adequate capacity and expertise, or for which it is possible to provide required training or bring in additional expertise.

P9. When feasible, select indicators that allow for information sharing, meta-analysis or interoperability with other projects, programmes, initiatives and frameworks to allow adaptive management and reporting to global mechanisms or platforms.[d]

SC39 Monitoring and sampling designs

Effective monitoring requires using reliable and repeatable approaches that have been designed specifically to address aims, objectives and questions related to the implementation and outcomes of restoration activities. For instance, to assess the extent of ecosystem recovery or progress towards restoration goals and objectives, the design involves comparing the condition of the areas where restoration activities were implemented to the reference model or other performance standards specified in restoration goals and objectives. On the other hand, to assess whether the restoration activities had an effect on the project site or surrounding landscape or seascape, it is necessary to compare changes in the system after restoration activities to background changes that would occur had the restoration not happened. To make that comparison, it is necessary to use a design that involves sampling treated sites (i.e. areas where restoration activities occurred) and control sites (i.e. areas that did not receive restoration activities), both before and after treatment; this design does not utilize a reference model or restoration goals and objectives. Thus, more than one monitoring design will be needed to assess both efficacy and effects, and specific monitoring designs will vary according to monitoring aims, objectives and questions – there is not one universally applicable design. Similarly, the sampling design (types and locations of subsampling units within sites) will vary based on monitoring aims, objectives and questions, as well as site characteristics.

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[d] See the global indicators by FAO and UNEP.[5]

Installation of a camera trap and plot survey markers in the Okapi Wildlife Reserve, northeastern Democratic Republic of the Congo

©FAO/Thomas Nicolon

A critical part of developing the monitoring design is determining the manner in which indicators (SC38) will be sampled and the number of landscapes or seascapes, sites (samples) and subsamples within sites that need to be monitored to have adequate power of detection for each. The sampling strategy used to estimate an indicator has a large effect on the value of the estimate as well as the required replication. For instance, estimates of vegetation cover vary greatly among sampling strategies (e.g. point-line intercept versus quadrat methods), as does the reliability of estimates achieved with a given number of samples. Similarly, when assessing cultural and socioeconomic factors, sampling strategies and required replication will vary based on the method of data collection. For instance, sampling strategies for surveying livelihood improvement in a representative sample of the local community will be different from strategies that involve using focus groups or interviewing stakeholders about their perceptions of benefits of restoration. Therefore, it is critical to optimize the sampling design and replication for each indicator, in order to have both successful and cost-effective monitoring. Although it may seem daunting to estimate sample sizes, with just a small amount of pilot data (or data from past projects at similar sites), determining sample sizes can be done quickly using simple mathematical calculations.

In addition to considering appropriate sampling strategies and adequate replication, the monitoring design should consider the frequency, seasonality and duration of monitoring. Monitoring time frames will vary by types of restoration activities, ecosystems and indicators; however, given that ecosystem restoration is a long-term undertaking, there are substantial benefits to developing the monitoring effort in ways that allow for monitoring to be continued long into the future. In order to make inference from data collected in different years, it is critical to use the same sampling methods and equipment.

Because monitoring aims and objectives include assessing the outcomes of restoration on a broad range of ecological, cultural and socioeconomic indicators, few scientists, practitioners, stakeholders or rights and knowledge holders will have the expertise to develop appropriate monitoring and sampling designs for all indicators. Consequently, interdisciplinary teams and expert guidance will be required to develop inclusive, effective and efficient designs.

P1. Collaboratively develop technically sound quantitative and qualitative monitoring and sampling designs by engaging experts and specialists from relevant disciplines and considering all types of knowledge, including local, traditional, practitioner, scientific and Indigenous Peoples' knowledge, about assessing the implementation and outcomes of restoration activities.

P2. Use monitoring and sampling designs that are designed specifically to address monitoring aims and objectives and answer questions about the implementation and outcomes (efficacy and effects) of restoration activities.

P3. For monitoring aims and objectives that include testing restoration outcomes (efficacy and effects), use monitoring and sampling designs that are scientifically valid (i.e. quantitative methods with adequate power of detection and valid qualitative methods) and that reliably separate the effects of restoration activities from background temporal and spatial variation that is not caused by restoration activities.

P4. For biophysical indicators, design monitoring with appropriate replication of control, treated and reference sites, as well as subsampling within sites, to have adequate power of detection.

P5. For socioeconomic and cultural indicators that require surveys, focus groups or interviews, use ethical practices and include appropriate replication of individuals.

P6. When feasible, select monitoring and sampling designs that allow for information sharing, meta-analysis or interoperability with other projects, programmes, initiatives and frameworks to maximize learning.

SC40 Data collection

The ability to track progress over time and answer monitoring questions depends on the reliability of collected data. Monitoring requires repeat observations over time and, because of this, often data are collected by different people throughout the monitoring programme. If there are large differences among data collectors in the way that observations are made, trends over time will be hard to discern. To facilitate consistent data collection, best practice is to develop a monitoring manual that documents specific protocols and forms for collecting ecological, cultural and socioeconomic information that can be shared with data collectors across sites and years, and used to train project personnel. As part of training, differences among data collectors (observer error) should be explicitly measured to test the reliability of each type of observation. Where high observer error is found, action should be taken to minimize error before starting sampling; for instance, data protocols could be revised or clarified, data collectors could receive additional training, or the indicator could be eliminated from the programme. Unless data reliability has been tested for each qualitative and quantitative indicator, learning from monitoring may be limited by inability to separate variation due to observer error (across sites or years) from actual changes in indicators due to restoration activities.

Data collection for all indicators should begin before restoration activities take place, to establish a baseline for the project. This pre-implementation sampling, described in the assessment component as baseline monitoring (SC4), is essential for assessing effects of restoration: the most reliable way to establish that activities had a causal effect is to compare change in monitoring indicators over time (before and after implementation) on restoration sites, with change over time on control sites (SC4). Without pre-treatment data, it is not possible to determine whether observed differences in monitoring indicators between restoration and control sites is due to restoration activities or background site-to-site variation.

Data collection may be desk-based (e.g. remote-sensing data), in field settings or via a combination of both. When in the field, care should be taken to take measurements during the optimal time period

Monitoring westslope cutthroat trout (*Oncorhynchus clarkii lewisi*) populations on Stoney Creek, Banff National Park, Canada

©Parks Canada/Nicole Sulewski

for each indicator and at the same period across years. For example, for plant species that die back during dry seasons, data collection may be harder or impossible during these periods. Furthermore, if data were to be collected in different seasons (dry versus wet) across years, measurements would not be comparable. In addition, when working in the field, it is important to ensure that safety precautions are taken, including having appropriate equipment and working only under suitable weather conditions. When collecting socioeconomic or cultural data that involve interviewing people, ensure that staff are well trained to avoid bias (e.g. when formulating questions and when recording answers), that the purposes of data collection are clear and that ethical requirements are being followed (e.g. in relation to storage of personal information), including compliance with FPIC when engaging with Indigenous Peoples. Doing so prevents harm and improves the quality of the data collected.

To avoid duplication of efforts, and save time and money, determine whether other organizations or individuals are already collecting data at the restoration site, and if so, whether these data could be utilized in lieu of additional data-collection efforts. Also consider adding partners to the project, such as academic institutions and community groups, that might reduce financial cost and at the same time empower the local community and build capacity.

P1. Consider the benefits of adding partners to data-collection efforts to facilitate the longevity of monitoring, reduce costs or address capacity-development needs.

P2. Determine whether there are ongoing data-collection efforts at the restoration sites, and if so, whether these data could be utilized to minimize data-collection efforts.

P3. Prior to collecting data, ensure that all data collectors are trained and that observer error has been assessed and is sufficient for each indicator.

P4. Collect baseline data prior to initiating restoration treatments on project sites as well as control and reference sites (where these types of sites are part of the monitoring design), using the indicators, protocols and forms specified in the monitoring and evaluation plan.

P5. Collect post-treatment data on project sites as well as control and reference sites (where these types of sites are part of the monitoring design), using the indicators, protocols, forms and time periods specified in the monitoring and evaluation plan.

P6. Collect data on restoration treatment implementation including the extent to which treatments were implemented as planned, treatment intensity and geographic coverage, as well as the conditions during treatment implementation (e.g. intensity of prescribed fire, weather conditions) to determine whether additional actions are needed and improve inference about the efficacy and effects of treatments.

P7. Document protocols and forms for collecting each type of ecological, cultural or socioeconomic data, including quantitative and qualitative data, interviews with people, and repeat photographs, in a monitoring manual.

P8. Ensure that ethical rules and regulations are followed when collecting (e.g. through surveys and interviews) and storing data from human subjects. Comply with the rights to anonymity, confidentiality and informed consent. Indigenous Peoples are holders and owners of their knowledge, with the right to decide the terms of knowledge collection. With Indigenous Peoples, it is mandatory to follow FPIC regarding data collection and data sovereignty.

P9. Obtain relevant ecological, cultural and socioeconomic data not directly gathered by the project but that may help to interpret trends, setbacks or surprises during project implementation.

SC41 Data management, analysis and evaluation

The purpose of collecting data is to use that data to evaluate the outcomes (efficacy and effects) of restoration activities. In order to be able to move to the analysis and evaluation phases, all data collected during the monitoring and evaluation component need to follow a data management plan (SC36, P6) that describes proper data handling, such as the file format and corresponding metadata and backup and archiving procedures, consistent with the restoration project's data and information management plan. Data management, analysis and evaluation should start as soon as possible after data have been collected, processed and cleaned to uncover, document and resolve any errors. Descriptive analyses including summary statistics for each indicator should be calculated to identify any errors, determine distributions and trends, and select appropriate tests to answer monitoring questions. In general, data analyses should follow the methods detailed in the monitoring and evaluation plan (SC36), to ensure that efforts address the predefined monitoring objectives and questions. In some cases, additional analyses may be needed, based on a preliminary review of trends.

Analyses should be done to understand the reliability of data, prior to interpreting results. Precision of estimation achieved for each monitoring indicator should be calculated and the reliability of proposed analyses should be tested. The validity of qualitative data analysis can be enhanced by triangulating, for instance, using member checking (results are returned to participants to check for accuracy and resonance with their experience) and a well-documented audit trail of materials and processes. Assessing precision and reliability is essential to interpret monitoring results. Care should be taken not to over-interpret results if the power of detection is limited. This will avoid confounding background variation with impacts of restoration.

After tests are conducted as detailed in the monitoring and evaluation plan, results should be described in compelling and easy-to-understand formats. For many types of results, graphing data may be the most impactful way to share information. Taking care to include appropriate contrasts within each graph plot is important, as when readers need to interpolate information across several plots, the story may not be evident. Furthermore, creating visual aids to help reinforce the data story in the graph is critical.

Evaluation of the results of monitoring should focus on the extent and strength of inference that can be made, explanations for observed trends, and comparisons with findings from other projects. Limitations to inference should be discussed, along with suggestions for improved monitoring. The evaluation should clearly communicate lessons learned, based on the analysis of monitoring data and discussions with stakeholders and rights and knowledge holders. This will be helpful for the future of the project and for other projects.

P1.	After data collection is complete, enter and clean data and document data validity and reliability (margin of error).
P2.	Analyse and evaluate data to determine the outcomes (efficacy and effects) of restoration (including ongoing management) and answer the monitoring questions, as specified in the monitoring and evaluation plan.
P3.	Determine sources of error and limitations to inference and consider these when evaluating lessons learned.
P4.	As part of the analysis process, share preliminary results with stakeholders and rights and knowledge holders to assist with identifying errors and with interpretation of lessons learned.
P5.	Summarize monitoring results and compile lessons learned, based on analyses as well as discussions of preliminary findings with stakeholders and rights and knowledge holders, in a format that is easily understood and accessible to allow information uptake by a wide range of audiences (SC44).

SC42 Evaluation of the effectiveness of the monitoring effort

To maximize learning from monitoring and evaluation, it is essential to periodically assess the effectiveness not just of the restoration activities, but also of the monitoring and evaluation effort itself. This is critical because when data are collected but cannot be reliably used, resources are wasted. Evaluating the effectiveness of a monitoring programme generally requires just a small fraction of available monitoring funds, and generally involves simple calculations. Despite this, the evaluation is not likely to be done unless it is a scheduled and funded activity within the restoration project's monitoring and evaluation plan. If resources are available, it is useful to include strategic peer review of the monitoring effort by appropriate experts.

One aspect of monitoring that should be assessed is the adequacy of the monitoring questions. In some cases, the questions set forth in the monitoring and evaluation plan may have been answered and no longer need to be addressed; in other cases, new questions may arise. In addition, the assessment should include an analysis of the adequacy of the monitoring design for answering monitoring questions, including whether the data-collection effort was sufficient. If monitoring indicators are undersampled, it may not be possible to make inference about the outcomes of restoration activities; conversely, if variables are oversampled, resources that could have been used for other parts of the restoration process would have been misappropriated. Another important aspect of assessing monitoring efforts is determining whether any indicator data that have been collected are not being analysed. If there are indicators that are not being analysed, efforts should be made to either analyse these data or stop collecting them.

The results of the assessment of the efficacy of the monitoring effort should be used to adaptively update the monitoring and sampling design. However, prior to changing any data-collection methodology, there is a need to carefully consider the effect that these changes will have on data analysis and interpretation. As an example, the sampling design selected for measuring vegetation substantially impacts the values of cover that will be observed, as some methods (e.g. point-line intercept) consistently yield higher cover values for common species than do others (e.g. Daubenmire plots). Therefore, changing sampling designs for measuring vegetation cover among sampling years would entirely confound changes due to restoration activities or time with error introduced by the differences in the method used to estimate cover. For this reason, it is critical to update the monitoring and evaluation plan, including the plan for data analyses, upon completion of the assessment of the monitoring effort.

P1.	Reassess monitoring needs throughout the project lifespan, including the resources needed to implement the monitoring programme.
P2.	Evaluate the effectiveness of the monitoring and sampling design and indicators for assessing restoration efficacy and effects, including replication at the landscape or seascape, site and subsample level.
P3.	Determine the need for adjusting administrative procedures associated with the monitoring process.
P4.	Use the findings from the assessment to update monitoring procedures and the monitoring and evaluation plan, including monitoring indicators and the plan for data analysis and interpretation.

Golden kelp (*Ecklonia cava*) drifting off the reef, eastern Australia

©Aaron Eger

SC43 Information management and record-keeping

Because restoration projects generate significant amounts of data, starting with the initial assessment and continuing with repeat monitoring measurements over long time periods, it is imperative that all monitoring documents and records, including the monitoring and evaluation plan, data-collection protocols, and databases, are appropriately managed and archived. For this reason, a data management plan is necessary to define data management policy (S36, P6), in accordance with the restoration project's data and information management plan (SC17). For example, all documents should be stored in formats that can be understood by someone who is not involved with the project. The way to do this is to create "metadata" – a legend that is a key to all other data in the database. For instance, for each indicator included in a database, there should be a plain language description (e.g. percent cover of vegetation determined by visual estimation within the sample plot) and the type of data (categorical or continuous) and allowable codes (with their definition) or ranges in values that can be entered. After preparing the database and metadata, it should be uploaded into an appropriate archival database. Depending on the entity who is conducting the monitoring, this may be a corporate or agency database, or a public one. Publicly accessible databases are increasingly being used for data archiving and may increase the likelihood of the data being accessed in the future to determine long-term trends, even if personnel involved with the monitoring have changed; data that is only archived on personal computers will be less accessible and may be lost over time. Safeguards for proprietary data (e.g. locations of endangered or culturally important species, or Indigenous Peoples´ knowledge) should be put into place as necessary.

P1. Maintain records of all monitoring information and data, reporting and communication, to inform adaptive management and enable future evaluation of responses to treatments, following procedures set forth in the restoration project's data and information management plan.

P2. As part of implementation monitoring, record all relevant details of restoration activities, including: frequency, duration and intensity; environmental conditions during the implementation period; and costs.

P3. When plants and animals are moved to a restoration site, record provenance, including source location (preferably derived from a global positioning system [GPS]) and a description of donor and receiving sites or populations. Documentation should include collection protocols, date of acquisition, identification procedures, vouchers and collectors' or propagators' names.

P4. Modify planning documents to reflect the actual implementation design and any site changes that may have occurred during implementation.

P5. Compile monitoring information into a written report or digital dashboard that includes findings and recommendations for addressing deficiencies.

P6. Compile maps related to monitoring and, when feasible, maintain geographic information system (GIS) databases with monitoring information to facilitate relocating monitoring sites, analysing and interpreting monitoring findings, and harmonizing with other projects.

P7. Include information (metadata) describing the contents of each archived dataset and record.

P8. Archive all collected data, records, reports, communications and maps, and ensure they are backed up and available in a format that is easy to share with others, when appropriate.

P9. Consider archiving data in open-access repositories or adding results to open-access repositories when appropriate.

P10. Follow procedures in the data authorship and access policy of the data and information management plan to protect knowledge rights for all project participants. In particular, Indigenous Peoples own their knowledge, so all activities related to their information management must recognize that they are, in perpetuity, the holders of their practices and contributions, and follow their FPIC.

Snow leopard (*Panthera uncia*) detected in a camera trap north of Issyk Khul Lake, Kyrgyzstan, as part of UNEP's Vanishing Treasures programme, in the area of the multicountry Mountain World Restoration Flagship

©UNEP/ Philippe Matheini and Michael Booth

SC44 Reporting and communication

Monitoring and evaluation has the potential to be a powerful tool for communicating the benefits of restoration for biodiversity, ecosystem integrity and human well-being, but investments will yield dividends solely if the insights garnered are transparently and effectively communicated to stakeholders and rights and knowledge holders. Furthermore, as restoration activities may not always lead to success and can sometimes result in unintended consequences, it is vital to communicate setbacks and surprises to prevent repetition of errors and promote adoption of good practices.

Discussions, consultations and exchanges about monitoring should be conducted with a wide array of stakeholders and rights and knowledge holders, including Indigenous Peoples and key groups, throughout the monitoring programme's life cycle. This should commence with formulating monitoring aims, objectives and questions. Preliminary findings should be shared and deliberated upon with all interested parties, thereby incorporating their wisdom and viewpoints into the evaluation, including identifying limitations to inference, prior to developing final reports.

To ensure transparency and comprehension, monitoring and evaluation reports and communications should be presented in a format that is easily understood and accessible to all stakeholders and rights and knowledge holders. The most appropriate format for summarizing and conveying data will differ by distinct types of stakeholders and rights and knowledge holders, cultural nuances and socioeconomic settings. For this reason, it may be necessary to develop multiple versions of reports and communications, each tailored to a specific audience. This approach can empower stakeholders and rights and knowledge holders to form opinions about restoration implementation and outcomes (effectiveness and effects) and collaborate on potential revisions to the restoration or monitoring and evaluation plan.

To facilitate the exchange of knowledge and information, monitoring information should be made widely available through regularly updated, easily accessible, understandable and culturally appropriate communications and dissemination channels (taking into account languages and literacy levels). When available, monitoring information should be shared on local, regional, global and ecosystem-specific platforms and networks. This availability will be determined by the project´s data authorship and access policy of the data management plan (SC43, P10).

P1. When appropriate, encourage open access to, and the sharing of, information and knowledge, while respecting intellectual property rights, the rights of stakeholders and rights and knowledge holders, and data-sharing agreements established during project planning and registered in the data authorship and access policy of the data management plan (SC43, P10). Given that Indigenous Peoples have the right to decide the terms of sharing their knowledge, FPIC should be followed during all stages of developing and implementing the communication strategy.

P2. Be mindful of the cultural codes for releasing information and disclosing details about engagement in the project by stakeholders and rights and knowledge holders.

P3. Communicate with stakeholders and rights and knowledge holders about ongoing monitoring and evaluation efforts to increase their understanding, trust and engagement.

P4. Include stakeholders and rights and knowledge holders in developing final reports that summarize findings from monitoring and evaluation.

P5. In reports that summarize findings, provide details of the monitoring methods (indicators, monitoring and sampling designs, data analyses) and results on which any evaluation of progress has been based.

P6. Communicate findings and lessons learned from monitoring and evaluation, including successes and setbacks and surprises, to stakeholders and rights and knowledge holders in culturally appropriate ways.

P7. Share information in face-to-face gatherings including field trips, when practical, to demonstrate examples of effective and ineffective practices.

P8. Prepare and disseminate reports that detail evaluation results for broader interest groups (e.g. in newsletters and scientific journals) to convey outputs and outcomes as they become available.

P9. Engage in restoration practitioner networks (local, regional and international) to maximize opportunities for sharing, and co-producing and communicating knowledge and lessons learned from monitoring and evaluation.

P10. As appropriate, upload results of project monitoring and evaluation to ecosystem restoration information management systems within the project region or country or at the international scale.[e]

P11. Strengthen public awareness on the importance of integrating in monitoring and evaluation all types of knowledge and practices, including local, practitioner, scientific and Indigenous Peoples' knowledge, by incorporating media and communication tactics, awareness-raising strategies and educational activities, among others.

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[e] The UN Decade FERM and other relevant platforms (e.g. the project database of SER's Restoration Resource Center and the International Union for Conservation of Nature's (IUCN) Restoration Barometer).

SC45 Adaptive management

Effective adaptive management requires executing monitoring and evaluation endeavours (as outlined in the sections above) in a manner that allows for adjusting the restoration process as needed. Furthermore, unless clearly defined tasks and timelines exist for integrating findings from monitoring and evaluation into the restoration process, this pivotal phase of the adaptive-management cycle may not get completed. To facilitate completion of this crucial step, it is imperative that the monitoring and evaluation plan outline the specific utilization of the findings and the allocation of funds to be used for the application of lessons learned.

P1. Use monitoring and evaluation results to assess whether restoration outcomes are on track to meet goals and objectives, or whether revisions are needed to the project plan, including restoration goals or objectives, implementation or ongoing management activities, or project timeline or budget.

P2. Identify enabling conditions that could improve project outcomes.

P3. Determine how to apply lessons learned to improve the restoration process, using participatory methods, tools and approaches that promote inclusiveness and involvement of relevant stakeholders and rights and knowledge holders.

American bison (*Bison bison*) in Yellowstone National Park, Montana, United States of America

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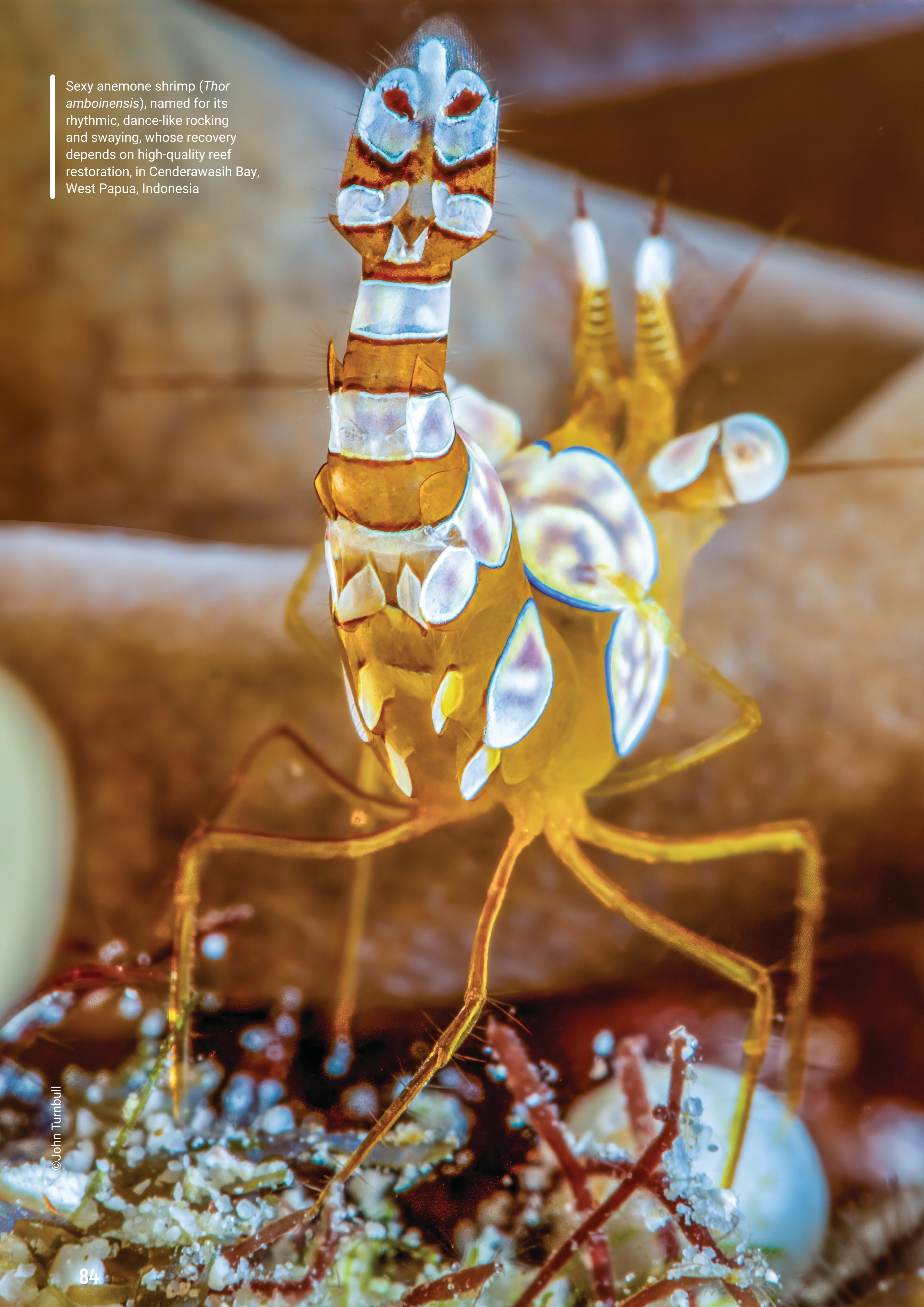

Sexy anemone shrimp (*Thor amboinensis*), named for its rhythmic, dance-like rocking and swaying, whose recovery depends on high-quality reef restoration, in Cenderawasih Bay, West Papua, Indonesia

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GLOSSARY

Terms in the glossary are limited to those that cannot be easily found (e.g. in an online dictionary), for which there are multiple definitions and therefore the meaning of which in the *Standards of practice* may not be clear unless stated, or for which the usage in the *Standards of practice* is nuanced or varies from that of common language. Definitions are direct quotes from the cited source, unless "adapted from" precedes the citation. The adapted definitions were created through an iterative process of revising text from the literature based on inputs and feedback from the global consultation (see the appendix). In a limited number of cases, definitions were developed during the process of drafting the *Standards of practice*, and, therefore, no citation is listed.

Cosmogony. The set of spiritual beliefs, rites, religious practices and customs that inform Indigenous Peoples' views of the ecosystem, nature and the world. Adapted from the definition by FAO.[6]

Customary law. Norms which have force within the community; when national legislation recognizes that customary law has force, the rules also become part of statutory law.[7]

Degradation. A persistent deterioration of the attributes of an ecosystem (e.g. abiotic condition, species composition, ecosystem structure and function, external exchanges) relative to reference conditions, due to direct (e.g. unsustainable resource use, land use change, overexploitation, contamination) or indirect (e.g. climate change) human intervention, that affects the ecosystem's capacity to provide benefits to people and nature. Adapted from Putz and Redford.[8]

Ecosystem integrity. The degree to which an ecosystem's physical condition, composition, structure and function are intact (that is, have not been degraded). Measuring ecosystem integrity is complex and requires understanding the range of states an ecosystem would have been in had degradation not occurred. Assessments of ecosystem integrity ideally should be based on a sufficient number of indicators of physical condition, composition, structure and function. The inverse of ecosystem integrity is ecosystem degradation.[9]

Ecological restoration. One of a broad array of restorative management activities that are considered ecosystem restoration under the UN Decade[1] (see Figure 2 on the restorative continuum). Ecological restoration is broadly defined as the process of assisting in the recovery of an ecosystem that has been damaged, degraded or destroyed. It differs from other ecosystem restoration activities along the restorative continuum in that it aims to recover a native ecosystem or landscape to the condition it would be in had degradation not occurred, while allowing for environmental change. Adapted from the definition by Gann *et al*.[10]

Ecosystem restoration. The process of halting and reversing degradation, resulting in improved ecosystem services and recovered biodiversity. Ecosystem restoration encompasses a wide variety of management activities (from reducing pollution to remediation to ecological restoration) that can be characterized along a restorative continuum, depending on local conditions and societal choice (see definition of the restorative continuum). Adapted from the definitions by Gann *et al*.[10] and UNEP.[11]

Free, prior and informed consent (FPIC). The collective right of Indigenous Peoples to make decisions through their own freely chosen representatives and customary or other institutions and to give or withhold their consent prior to the approval by government, industry or other outside party of any project that may affect the lands, territories and resources that they customarily own, occupy or otherwise use.[12]

Goal. A formal statement of a project's long-term desired outcomes, such as the desired future status of a target. A goal should be specific, measurable, achievable, results oriented and time-limited (SMART).[13]

Implementers. An individual, group or team (including community members, Indigenous Peoples, practitioners, researchers, farmers, ranchers, landowners, land users and others) that carries out the work of restoration implementation in accordance with a restoration plan. All practitioners are implementers. However, not all implementers are practitioners as some may not have professional training or accumulated knowledge (see definition of practitioner).

Indicator. A variable used to measure the state of the restoration project sites before and after restoration activities take place, to determine progress towards the project's vision, targets, goals and objectives. Indicators should be specific enough that they can be expressed in measurable units (e.g. biomass of native plants in kilograms per hectare; household income in USD). A project's indicators should enable capture of both positive and negative, and intended and unintended, impacts of restoration.

Indigenous Peoples. In accordance with international consensus, the four following criteria apply when considering Indigenous Peoples: priority in time, with respect to occupation and use of a specific territory; the voluntary perpetuation of cultural distinctiveness, which may include the aspects of language, social organization, religion and spiritual values, modes of production, laws and institutions; self-identification, as well as recognition by other groups, or by state authorities, as a distinct collectivity; and an experience of subjugation, marginalization, dispossession, exclusion or discrimination, whether or not these conditions persist.[14]

Indigenous Peoples' biocentric restoration. An approach to ecosystem restoration developed together by Indigenous Peoples' leaders and the FAO Indigenous Peoples Unit in 2018. In the context of the UN Decade, the concept is defined as an alternative way of restoring degraded ecosystems, placing at the centre Indigenous Peoples' cosmogony, knowledge, culture, beliefs and territorial management practices, with the main aim of re-establishing the forgotten memory of the territory. Adapted from the definition by the FAO Indigenous Peoples Unit.[15]

Indigenous Peoples' biocultural restoration. Restoration actions made in the service of sustaining the biophysical and sociocultural components of dynamic, interacting, and interdependent social-ecological systems. Adapted from IPBES's definition.[16]

Indigenous Peoples' food systems. A series of elaborated territorial management techniques that, rooted in unique cosmogonies and beliefs, have helped develop intricate bodies of traditional knowledge. This traditional knowledge depends on the oral transmission ensured through the use of Indigenous Peoples' languages. These languages are key in ensuring intra- and intergenerational transmission of knowledge. They also inform ancestral institutions and customary governance systems that see ecosystems and the environment through a biocentric lens. The biocentrism in Indigenous Peoples' food systems looks at all living beings in the ecosystem with spiritual importance and gives attention to the relations between the different elements that maintain the balance in the ecosystem. Indigenous Peoples' food systems often include mobile livelihoods, which rely on collective rights to communal resources. Food generation is as important as food production, with activities that are productive, such as farming, aquaculture and rearing, and others that are not, such as fishing, hunting, harvesting and gathering. The broad food base of Indigenous Peoples' food systems can consist of up to hundreds of species for food and non-food uses of wild, semi-domesticated and domesticated animals and plants. Indigenous Peoples' food systems have been providing foods for Indigenous Peoples' communities for hundreds of years, yet they have also managed to preserve 80 percent of the world's remaining biodiversity. The social fabric and cohesion in Indigenous Peoples' communities is intrinsically linked to communal practices and mechanisms that are based on the concepts of reciprocity, circularity and solidarity.[17]

Indigenous Peoples' knowledge. Cumulative body of knowledge, practices and manifestations maintained and developed by Indigenous Peoples with long histories of interaction with their natural environment. Indigenous Peoples' knowledge is adapted to the local culture and transmitted orally from generation to generation.[6]

Indigenous Peoples' tenure. The rights that Indigenous Peoples traditionally have over land, fisheries and forests to occupy, use, develop, enjoy and withdraw benefits from the natural resources, as well as the right to restrict others' access to these resources; and the right to manage, sell or bequeath the resources.[18]

Indigenous Peoples' territories. Indigenous Peoples do not have rights only to the land they directly cultivate or inhabit, but to the broader territory, encompassing the total environments of the areas which they occupy or otherwise use, inclusive of natural resources, rivers, lakes and coasts. This term is in line with Article 26 of the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP)[4].[19]

Landscape. A bounded area (at any spatial scale) of interacting ecosystems with discrete ecological composition, structures and functions, and human communities with discrete socioeconomic and cultural characteristics. Adapted from Forman and Godron's definition[20] and Wu's definition.[21]

Net gain. A positive improvement from restoration's contributions to biodiversity, ecosystem integrity and human well-being, using the degraded state as a baseline, and measured at appropriate temporal and spatial scales. Measurement of net gain should include intended as well as unintended consequences of restoration activities, within and outside the restoration site. Because net gain by definition is measured against the degraded baseline, it only applies to ecosystems that have been degraded (i.e. it is not appropriate to measure net gain of non-degraded ecosystems). Modified from outputs of the third Global Forum on Ecological Restoration, hosted by SER and IUCN CEM, 2021.

Objective. A formal statement of the desired short- and medium-term changes in the project's **indicators** that are necessary to attain the restoration goals. Objectives should meet SMART criteria: specific, measurable, achievable, relevant and time-limited. Adapted from the definition by Conservation Measures Partnership.[13]

Practitioner. An individual who, with a professional vocation or judgement from accumulated knowledge, applies technical skills, experience and knowledge to plan, implement, monitor and sustain ecosystem restoration tasks at project sites. Adapted from the definition by Gann *et al*.[10]

Reference model. A model that characterizes the ecological condition that the restoration project site would be in if degradation had not occurred. Because an inherent property of ecosystems is that they change over time, the goal of this model is not to characterize pre-disturbance conditions, but rather the condition that the site would have been in now, which incorporates potential change over time. The reference model provides information on mean and variation in each element of ecosystem integrity, including species composition, ecosystem structure and functions, physical conditions and connectivity with the larger landscape or seascape. Reference models are developed using multiple sources of information. Best practice is to construct reference models empirically from a suitable number of reference sites, augmented with best available information from multiple other sources. For heavily impacted landscapes, there may be an insufficient number of (or no) available reference sites. In these cases, other information sources, such as successional models and historical information from natural and written archives, must be used to construct a theoretical reference model. Adapted from the definition by Gann *et al*.[10]

Reference site. A site that is environmentally similar to the project site (site to be restored) but that has experienced little to no anthropogenic degradation. Where available, an appropriate number of reference sites can be used to reliably characterize the mean condition (and range of variability) that the restoration project site would have been in had degradation not occurred. Adapted from the definition by Gann *et al*.[10]

Restoration target. An ecological, socioeconomic or cultural element on which the project has chosen to focus. All targets should collectively represent the elements of concern within the project site. Adapted from the definition by Conservation Measures Partnership.[13]

Restorative continuum. The range of ecosystem restoration activities ordered based on the degree to which they recover biodiversity, ecosystem health and integrity, and human well-being. At one end of this continuum are management activities aimed at reducing societal impacts, such as runoff into urban streams, and mitigating threats such as contaminated soils. The other end of the continuum includes ecological restoration, which aims to both remove degradation and recover ecosystems to the condition that they would be in had degradation not occurred, while allowing for environmental change. Adapted from the definition by Gann *et al*.[10]

Rights and knowledge holders. Any person, group of persons or entity (typically Indigenous Peoples) who holds customary or legal use rights, in accordance with the UNDRIP[4] and national laws or traditions, and the recommendations of the United Nations Permanent Forum on Indigenous Issues (UNPFII). Adapted from Preferred by Nature's definition.[22]

Seascape. A bounded area of interacting ecosystems (at any spatial scale) in marine environments, with discrete ecological composition, structures and functions, and human communities with discrete socioeconomic and cultural characteristics. Adapted from Pittman's definition[23] and Wu's definition.[21]

Stakeholders. Any individual, group, organization or sector in society that has a clearly identifiable interest in the outcome of a policy or decision-making situation. The interest may be in the form of a specific management responsibility, a commercial interest (e.g. resource supply, revenue, employment, trading activity), a subsistence need or some other commitment, as a member of civil society.[24]

Vision. A general statement of the desired state or ultimate condition that a project is working to achieve.[13]

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Many of the practices recommended in the *Standards of practice* were drawn directly from the publications below, representing the work of many experts, agencies and organizations over decades. Thus, all the authors who contributed to these publications, including ecosystem restoration practitioners, contributed to the development of the *Standards of practice*. We are grateful for their individual and collective contributions, which made development of the *Standards of practice* possible. Although recommended practices generally were modified to synthesize recommendations among publications and maximize application to the broad array of restorative activities under the UN Decade, in some cases, the original wording of recommendations has been maintained.

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